

**Table 15**

**New Product Introductions - 1989**

**Japan:**

Merit Lights KS SP - Philip Morris  
Merit Lights KS Box - Philip Morris  
Lark KS Box - Philip Morris  
Lark Super Lights - Philip Morris  
L&M Milds KS Box - Philip Morris  
Parliament Lights 100 Box - Philip Morris  
Parliament KS Box - Philip Morris  
Vantage KS SP - R.J. Reynolds  
Camel Lights KS Box - R.J. Reynolds  
London Lights KS Box - The London Tobacco Co.  
Ducal Menthol KS Box - The London Tobacco Co.  
Marlboro KS Box - JTI  
Marlboro Lights KS Box - JTI  
Mild Seven Super Lights 85 SP - JTI  
Claris Lights Menthol KS SP - JTI  
Sometime Lights KS Menthol Box - JTI  
Cabin Mild KS Box - JTI  
Cabin Super Mild KS SP - JTI  
Epique 100 Menthol Superslims - JTI  
Beside KS SP - JTI  
Peace International 95 Box - JTI  
With Class KS Box - JTI  
Lucky Strike Milds KS SP - Brown and Williamson  
Kent Deluxe Milds 100 Box - Brown and Williamson  
Barclay KS SP - Brown and Williamson  
Barclay KS Box - Brown and Williamson  
Gitanes Lights KS SP - S.E.I.T.A.  
Parisienne Mild KS Box - F.J. Burrus  
Pierre Cardin Lights Box - F.J. Burrus  
Craven "A" 100 Box - The House of Craven  
Craven "A" 100 Super Mild Box - The House of Craven  
Vogue 100 Box Superslims - American Cigarette Co. Ltd.  
Vogue Menthol 100 Box Superslims - American Cigarette Co. Ltd.  
Peter Stuyvesant KS SP - American Cigarette Co. Ltd.

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**Table 15 (continued)**

**New Product Introductions - 1989**

**Japan:**

American Super Lights 100 SP - The American Tobacco Co.  
Maryland KS SP - C.I.T. Monte Paz S.A.  
Ark Royal KS SP - C.I.T. Monte Paz S.A.  
San Chl KS SP - Yuxi Cigarette Factory, China  
Shiwn KS SP - Kumming Cigarette Factory, China

**Turkey:**

Tekel 2000 - Tekel

**Hong Kong:**

Marlboro Lights Menthol Box - Philip Morris

**Taiwan:**

Virginia Slims Lights - Philip Morris  
Virginia Slims Lights Menthol - Philip Morris

**Korea:**

Mt. Halla - Korean Tobacco & Ginseng  
Lilac - Korean Tobacco & Ginseng  
Virginia Slims Lights - Philip Morris  
Finesse  
Cartier

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Table 16

**Philip Morris U.S. Exports  
Brand Family Market Performance**

Market Share Direction by Brand Family

	<u>Marlboro</u>	<u>Lark</u>	<u>Philip Morris</u>	<u>Parliament</u>	<u>Visa</u>	<u>Virginia Slims</u>	<u>Merit</u>
Japan	N.A.	(+)	Stable	(+)	N.A.	(+)	N.A.
Turkey (Domestic)	(+)	N.A.	N.A.	(+)	N.A.	N.A.	N.A.
Saudi Arabia	(-)	N.A.	N.A.	N.A.	(-)	N.A.	N.A.
Hong Kong	(+)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Taiwan (Import Mkt)	(-)	(-)	N.A.	(+)	N.A.	N.A.	N.A.
Korea (Import Mkt)	(+)	(+)	N.A.	(+)	N.A.	N.A.	N.A.

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Table 17

Philip Morris U.S. Exports  
(Billion Cigarettes)

	Actual Sales		Production Forecast			C.A.G.*			
	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1990-1995</u>
Total Export	68.8	78.0	103.3	112.2	121.5	125.6	130.3	133.9	5.3%
Major Markets:									
Japan	20.6	26.5	33.1	37.0	40.7	44.8	49.3	54.2	10.3%
Turkey (Domestic)	8.6	10.2	13.9	16.7	17.3	15.1	13.1	9.5	-7.3%
Saudi Arabia	4.2	4.5	5.3	5.3	5.5	5.6	5.7	5.7	1.7%
Hong Kong	2.7	2.8	3.2	3.3	3.4	3.6	3.7	3.9	4.4%
Taiwan	3.4	2.4	2.9	3.4	3.4	3.5	3.6	3.7	4.9%
Yugoslavia	0.6	0.7	2.4	3.9	3.9	3.9	4.0	4.0	10.7%
Kuwait	1.2	1.4	0.9	0.0	1.6	1.6	1.6	1.7	13.0%
Korea	0.5	1.1	1.5	2.2	2.4	2.7	2.9	3.1	15.5%
Other Levant (USSR)	0.1	0.1	2.4	3.4	3.4	3.5	3.5	3.5	8.0%

\*Compounded Annual Growth

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**Table 18**  
**Philip Morris U.S. Exports**  
**Market Share (%)**

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>C.A.G.*</u> <u>1987-1989</u>
Japan	1.5	1.7	2.6	5.2	6.8	8.4	+27.1%
Turkey (Domestic)	1.3	4.5	9.4	13.3	12.3	13.7	+1.5%
Saudi Arabia	35.4	35.7	36.7	39.7	38.9	38.3	-1.8%
Hong Kong	25.9	29.4	33.0	36.0	36.8	37.6	+2.2%
Taiwan	0.2	0.2	0.2	8.2	9.5	8.6	+2.4%
Korea	-	-	0.02	0.06	0.6	1.1	+3.3%

\*Compounded Annual Growth

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**Table 19**  
**Philip Morris U.S. Exports**  
**Share of Import Markets (%)**

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>C.A.G.*</u> <u>1987-1989</u>
Japan	74.8	74.4	74.7	62.0	58.5	59.0	-2.4%
Turkey (Domestic)	51.8	73.3	86.5	88.6	85.8	86.0	-1.5%
Saudi Arabia	35.4	35.7	36.7	39.7	38.9	38.3	-1.8%
Hong Kong	41.4	52.4	55.8	67.2	65.5	63.9	-2.5%
Taiwan	14.2	13.6	12.2	49.8	59.3	59.9	+9.7%
Korea	-	-	35.0	31.2	37.2	30.2	-1.6%

\*Compounded Annual Growth

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Table 20

**Worldwide, International and Domestic  
Market Trends\* (In billions)**

<u>Industry</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>Compounded Annual Growth Rate 1986 - 1989</u>
Total Worldwide	4,975.0	5,118.0	5,200.0	5,350.0	+2.4%
Total International	4,391.5	4,547.0	4,642.2	4,826.1	+3.2%
Total Domestic	583.5	571.0	557.8	523.9	-3.5%
<u>Philip Morris</u>					
PM Worldwide	506.8	540.8	556.4	582.4	+4.7%
Market Share	10.2%	10.6%	10.7%	10.9%	
PM International	292.3	325.2	337.1	362.9	+7.4%
Market Share	6.7%	7.2%	7.3%	7.5%	
PM Domestic	214.6	215.6	219.3	219.5	+0.75%
Market Share	36.8%	37.8%	39.3%	41.9%	

\*Figures include cigarettes designated for the military.

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Opportunities exist in the menthol markets of Japan, Hong Kong and Taiwan, with Salem as the driving competitive force. The major Asian markets all offer product opportunities in the low tar segments as smokers trade down to these brand types. The Korean market, in particular, provides opportunity for growth in products which have low and ultra low tar deliveries.

**R&D Response:**

Remain attuned to marketplace needs/wants through market tracking and full utilization of existing consumer panels.

Establish new consumer panels in international markets when possible.

Counter foreign competition with product development strategies which are innovative and aggressive.

Market-tailored product development programs.

Continue to support PM Europe R&D to provide effective solutions to problems common to both markets.

Aggressively pursue new product development opportunities as follows:

- Low Tar and Nicotine product development
- Menthol product development
- Project Ring (Korea)
- Market-tailored product development
- Project ART
- Sidestream products

**R&D Programs:**

- International Product Support
- Filtration Research
- Paper Technology/Reduced Sidestream
- Project ART

**Alternate Scenario:**

A lower volume increase could result if anti-smoking groups impact the Asian markets. New markets may not be opened to allow foreign competition.



### **R&D Response:**

The R&D response remains the same.

### **SEGMENTED CIGARETTE MARKET TRENDS**

#### **Status**

A graphic analysis of each product category (non-filter, menthol, full flavored filter, lights filter, ultra low tar filters, slims/120's filter, generic, branded generics, value 25's, "price-off" (brands which carry a permanent coupon), and export is found in Appendix J. Both market share and growth rate data (1987-1989) are provided for each company and category. From this information, the following summary has been prepared to indicate which segments are dominated by PM products and which segments are underrepresented by PM products. PM does not compete in the "price-off" segment.

#### **Market Segments Dominated by PM:**

- Full Flavor Filter
- Lights Filter
- Ultra Lights Filter
- Slims/120's Filter
- Value 25's
- Export

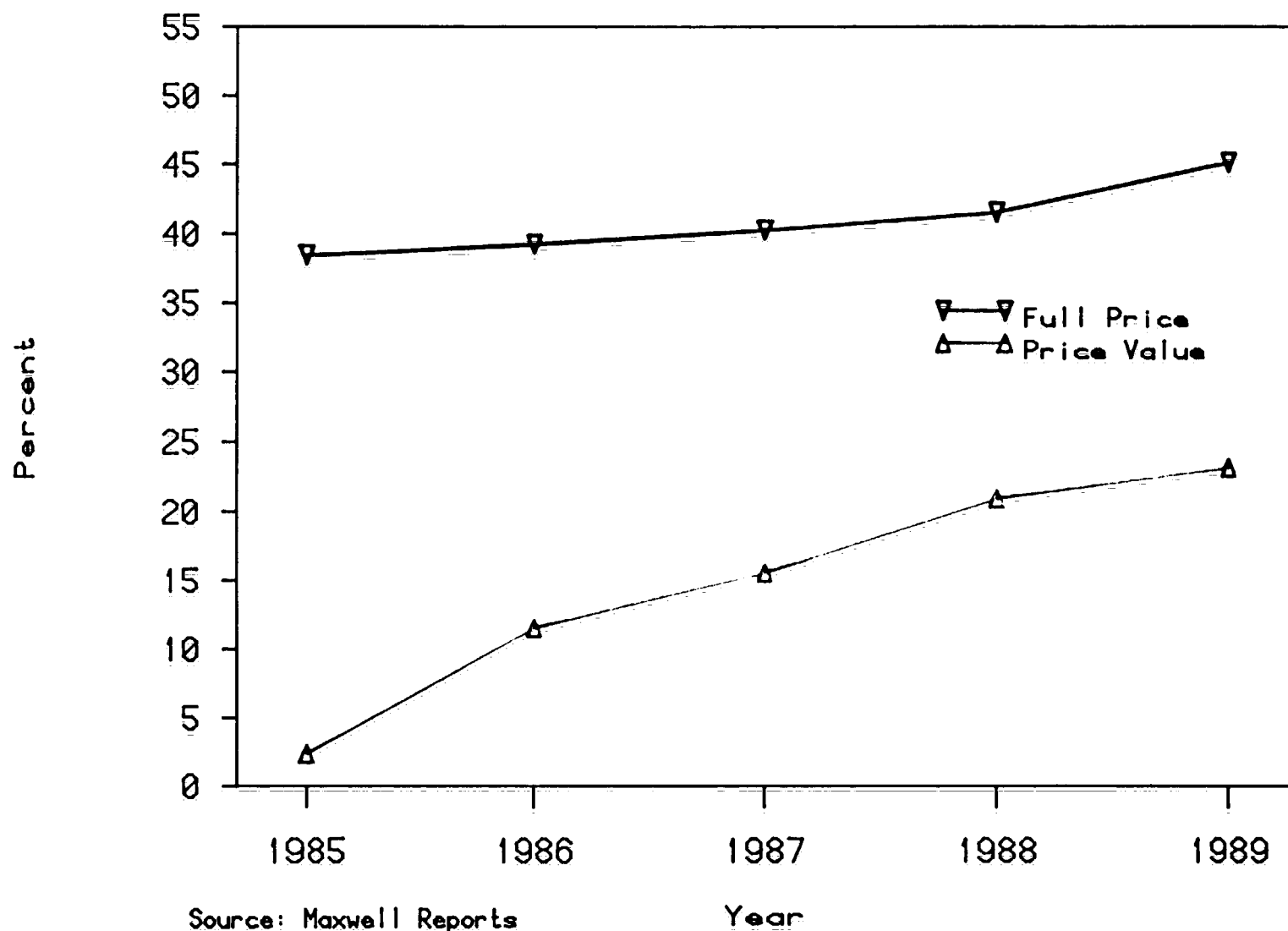
#### **Market Segments Underrepresented by PM:**

- Menthol
- Ultra Low Tar
- Price/Value

**Menthol** - The segment declined in 1989 to 140.81 billion units, but comprises 26.9% of the U.S. cigarette market. Salem and Kool declined while Newport increased to a 4.7% share. PM's Alpine showed growth with its entry into the price value category, and PM continued to dominate the 100mm menthol segment. However, PM remains underrepresented in the King Size menthol market (Figure 7). Although our market share is increasing slowly in the menthol segment (Figure 8), there is considerable discrepancy between our share of the menthol and non-menthol segment. R&D needs to continue to research the menthol market and develop menthol products which will provide a product advantage.

Figure 7

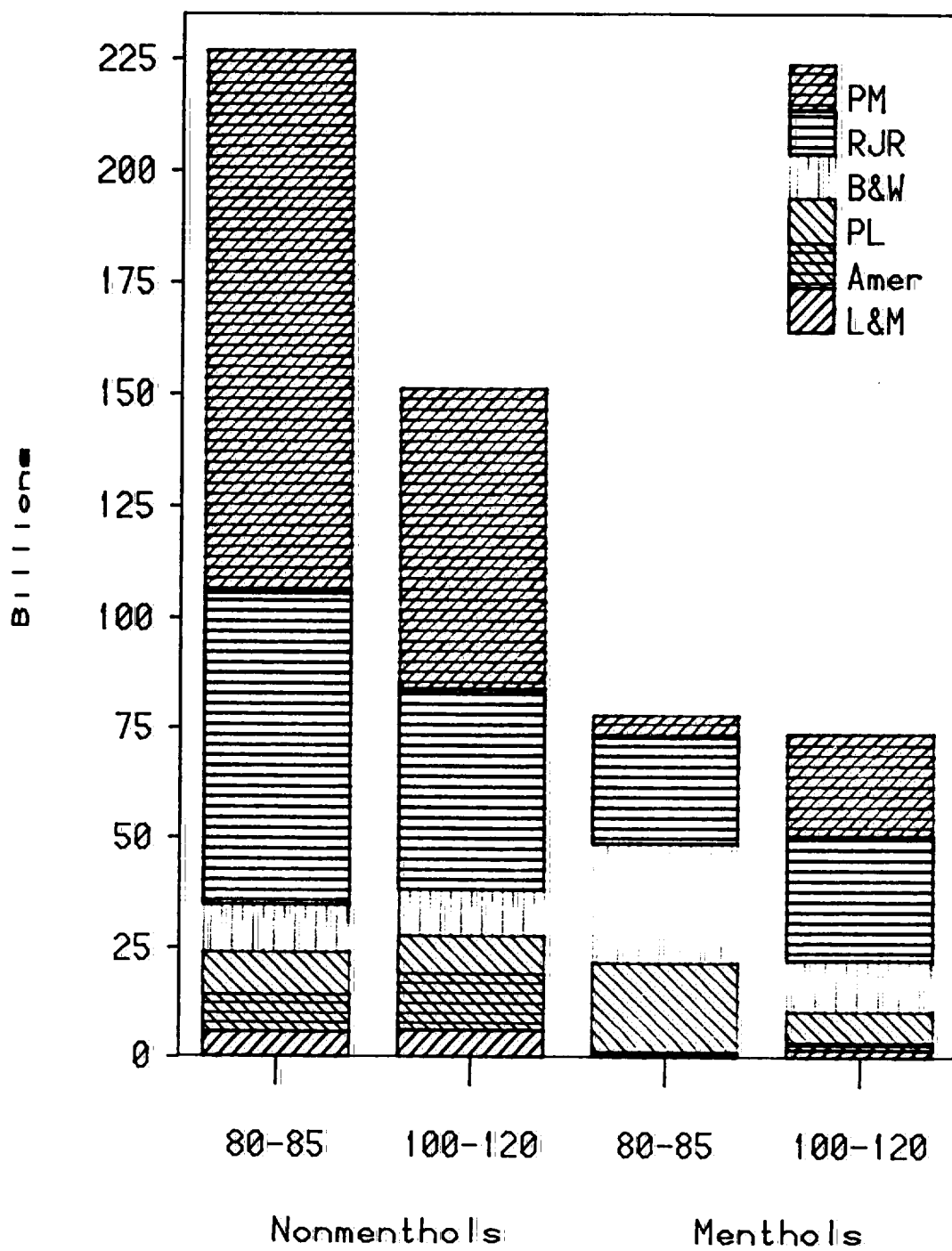
PM Share of Market, 1985-1989



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Figure 8

# Share of the Market



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**Ultra Low Tar (<5.0mg tar)** - While PM has a steady and respectable share of the full flavor and flavor low (lights-filter) markets, the ultra low segment shows an increase but still offers more opportunity for growth (Figure 9). Carlton (American Brands, Inc.) and Now (RJR) dominate this category and have a combined share of 2.7%, which has been constant for three years. This category is driven by health conscious consumers. The Low Tar/High Flavor Program (Project BOLD) spearheads our development efforts in this area along with developments from filter technology and paper technology.

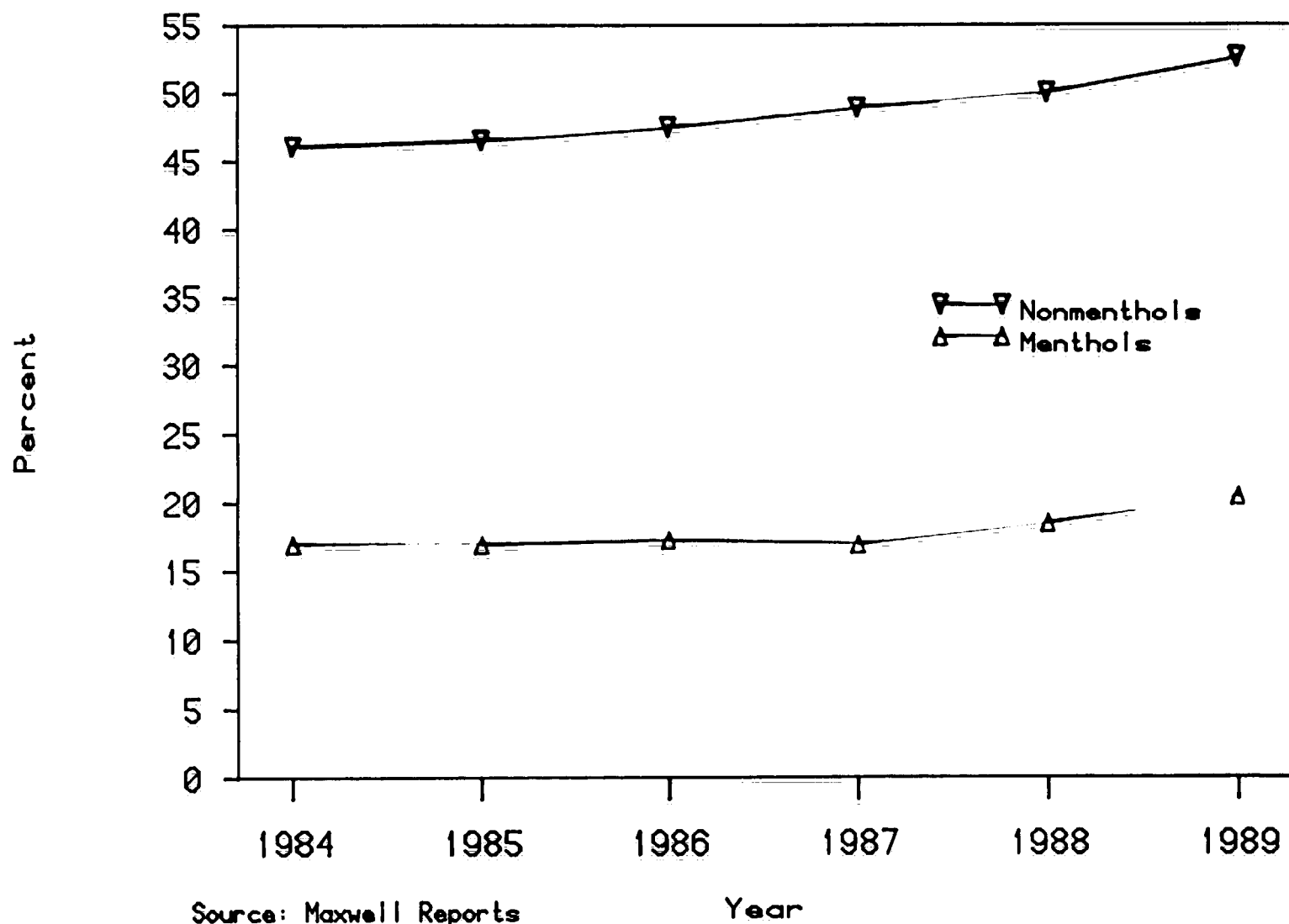
In spite of an overall industry decline in unit volume, PM has achieved growth in the following segments from 1987-1989: total domestic market, lights filter segment (growth in Marlboro Lights); ultra lights filter segment (growth in Merit Ultra Lights); branded generics (growth in Cambridge, Alpine repositioning); generics; export (growth in most markets); and sub-generic (due to recent Bristol introduction).

**Price Value** - Figure 10 shows that while PM's share of the price/value segment is growing, PM is significantly underrepresented in this area. The trends from 1988 and 1989 place this segment as the fastest growing and most active with new product introductions. 1989 saw the expansion of the category with the introduction of Pyramid (one of the most successfully introduced products in recent history) into the sub-generic price level. As of November 1990, Pyramid had a respectable year-to-date market share of 1.32%. PM has strong entries in this category with the branded generics Cambridge, Alpine and now Bucks in test market. The brand Bristol was introduced into the sub-generic price level.

As state governments increase taxes on cigarettes and the federal government increases excise taxes in an attempt to reduce the budget deficit, the price/value trend is likely to intensify. In addition to placing competitive products into the market place, we need to develop product specifications which are as cost effective as possible. The development of non-tobacco materials which are both functional and cost effective is a key element of these specifications. Our overall approach is to give the consumers a product of acceptable quality at competitive costs.

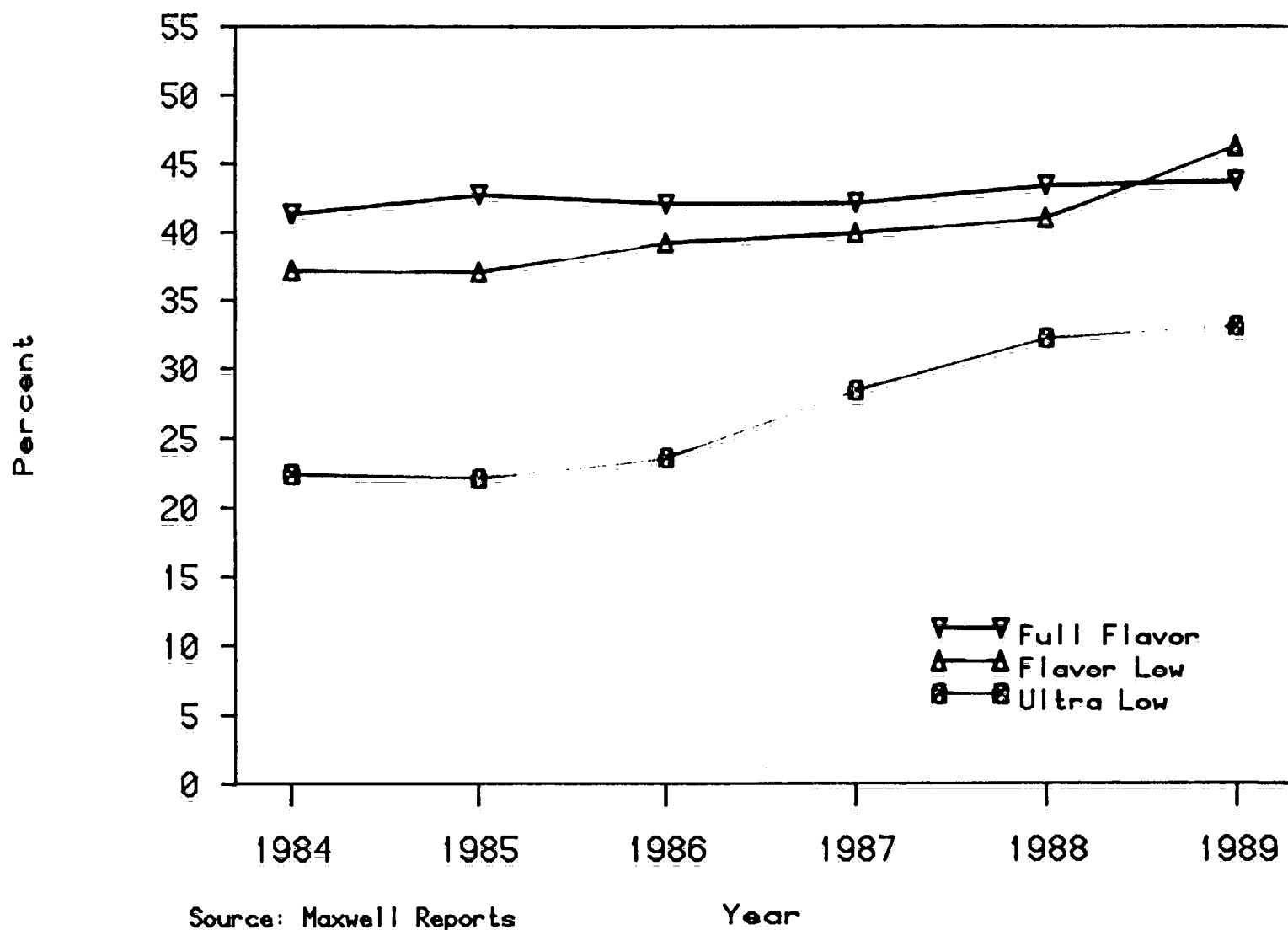
As has been mentioned, taxes on cigarettes are increasing. This, along with industry pricing policies, means our consumers are paying more for a pack of cigarettes. Thus, it is important to increase value to the consumer by maximizing the quality of our full margin brands. Maintaining subjective quality, automated inspection systems, freshness improvements, maintaining consistency and improved packaging are potential ways to increase benefit to the consumer. Maximizing the potential of our full margin brands will have a more significant impact on our profitability.

Figure 9  
PM Share of Market, 1984-1989



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Figure 10  
PM Share of Market, 1984-1989



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A summary of PM's position relative to total market share and volume growth is shown in Table 21. This table shows that PM is positioned well and dominates all market segments which account for more than 5% of the industry's market volume with the exception of the menthol category. Table 22 provides an overview of the products and companies having significant impact in the compounded annual growth rates reported in Table 21. Recommendations on PM USA R&D's response to these market dynamics are consistent with those discussed in the section on Competitive Pressures-Domestic. These market trends, however, clearly provide additional information on the status of each segment (growing or declining) and assists in the proper positioning of PM products. For example, PM is underrepresented in the non-filter segment. However, the rapid decline of this segment (compounded annual industry growth rate 1987-1989 of -13.2%) and the minor contribution of this segment to the overall market (4.1%) lead to the conclusion that the non-filter segment is not of strategic interest. Social/political factors (health concerns and governmental regulations) support this conclusion.

PM's strategic approach to the price/value segment would be served best with branded generics (compounded annual industry growth rate 1987-1989 of +39.3%) and with the newly launched sub-generic category.

#### **R&D Response:**

Develop products with the aim of increasing market share in the following segments:

- Ultra Low Tar
- Menthol
- Price/Value

#### **R&D Programs:**

- Domestic Product Development
- Menthol
- Low Tar/High Flavor (Project BOLD)
- Filtration Research
- Flavors

#### **PROJECTED SALES VOLUME**

##### **Status:**

Projected Sales Volume figures from 1991-1995 are shown in Table 23. These figures reflect a forecasted increase in total PM volume of +2.7% over 1990 projected sales, and

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Table 21

**PM Versus Industry  
Market Share and Growth**

Rank in Total Market	Segment	Share of Market Volume*	Total Industry 1987-1989	Total Industry Minus PM 1987-1989	PM's Growth in Segment	PM's Share Of Segment
			Growth Rate of Segment	Growth Rate of Segment		
1.	Export	27.2%	+16.9%	+23.6%	+12.3%	56.2%
2.	Full-Flavored Filter	26.0%	-8.7%	-16.9%	-2.5%	62.5%
3.	Menthol	25.6%	-6.5%	-7.4%	-2.8%	19.2%
4.	Light Filter	21.5%	-4.1%	-12.5%	+1.6%	65.1%
5.	Branded Generics	10.1%	+39.3%	+34.6%	+53.7%	28.6%
6.	Ultra Light Filter	4.9%	-4.2%	-8.8%	+3.5%	41.6%
7.	Non-Filter	4.1%	-13.2%	-13.2%	-14.6%	1.6%
8.	Slims/120's	2.9%	-5.7%	-9.5%	-3.0%	61.4%
9.	Generics	2.7%	-22.3%	-25.6%	+35.2%	12.0%
10.	Ultra Low Tar (<0.5 mg tar)	1.6%	-9.8%	-5.0%	-82.7%**	0.4%
11.	Price-Off	2.0%	+0.5%	+0.5%	--	--
12.	Sub-Generics	0.9%	--	--	--	4.5%
13.	Value 25's	0.4%	-36.3%	-41.5%	-25.7%	41.0%

\*Products may have been considered in more than one segment.

\*\*Cambridge <0.5 discontinued.

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Table 22.

**Products/Companies Having Significant Impact on the 1987-1989  
Compounded Annual Growth Rate for Domestic Product Sectors**

<u>Segment</u>	<u>Industry - PM</u>	<u>PM</u>
1. Full-Flavor Filtered	(-) Winston	(-) Marlboro
2. Export	(+25.6%) RJR (+22.4%) B&W (+8.7%) AB	(+12.3%) PM
3. Menthol	(-) Salem (-) Kool (↔) Newport	(-) Marlboro Menthol (-) Marlboro Lts. Menthol (-) Va Slims Menthol (-) Cambridge Lts. Menthol
4. Lights Filter	(-) Winston Lights	(+) Marlboro Lights
5. Branded Generics	(+) Doral (+) Richland (+) American Lts.	(+) Cambridge (+) Alpine
6. Ultra Light Filter	(-) Winston UL (-) Vantage UL (-) Kent UL	(+) Merit UL
7. Non-Filter	(-) Camel (-) Pall Mall (-) Lucky Strike (-) Chesterfield	(-) Commander
8. Slims/120's	(-) More	(-) Virginia Slims (-) Saratoga

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Table 22 continued)

**Products/Companies Having Significant Impact on the 1987-1989  
Compounded Annual Growth Rate for Domestic Product Sectors**

<u>Segment</u>	<u>Industry - PM</u>	<u>PM</u>
9. Generics	(-21.3%) B&W (-29.1%) LG	(+35.2%) PM
10. Ultra Low Tar (0.5 mg tar)	(-) Now (-) Barclay	(-) Cambridge (<0.5) discontinued
11. Price-Off	(-) Raleigh (-) Belair (+) Malibu (-) Chesterfield	
12. Sub-Generic	(+) Pyramid	(+) Bristol
13. Value 25's	(-) Richland 25's (-) Newport 25's	(-) Players Lts. 25's

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Table 23

**PM USA FIVE YEAR FORECAST**  
**11/20/90**

	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
<b>Marlboro</b>						
Non-menthol (E)	132,561	133,423	126,547	124,019	118,902	116,281
Menthol	2,311	2,105	1,958	1,801	1,693	1,591
New	308	360	7,405	10,025	16,757	19,516
Total Marlboro	135,180	135,888	135,910	135,845	137,351	137,388
Benson & Hedges	18,567	17,813	21,096	19,625	17,982	16,535
Mertit	18,468	16,486	15,059	15,371	14,369	14,465
Next	40	60	60	60	60	60
Virginia Slims	16,135	14,966	14,243	13,726	13,387	12,829
Parliament	4,327	4,025	3,804	3,497	3,289	3,125
Other Full Margin	1,731	1,551	1,380	1,185	1,043	939
 Cambridge	13,178	14,082	15,110	16,723	18,123	19,559
Alpine	3,286	3,333	3,516	3,893	4,223	4,560
Bristol	4,029	5,441	6,206	7,345	8,186	8,865
Players 25's	680	516	422	363	327	302
FVB	3,120	4,080	4,008	3,835	3,531	3,242
Bucks	1,259	3,060	3,187	3,530	3,827	4,133
New Products (Net)	0	0	0	0	0	0
 Total Full Margin	194,448	190,788	191,551	189,311	187,483	185,339
Total Price Value	25,552	30,512	32,449	35,689	38,217	40,661
Total PM USA*	220,000	221,300	224,000	225,000	225,700	226,000
 Industry	526,750	507,900	495,300	479,000	467,100	455,500
Full Margin	427,721	397,686	377,914	353,502	338,180	323,405
Price Value	99,029	110,214	117,386	125,498	128,920	132,095

\*Domestic Only

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an increase in PM market share from 41.7% in 1990 to 49.6% in 1995 in spite of a total industry decline of 13.5% from 1990 to 1995.

#### **R&D Response:**

Several key strategies will be necessary to maintain income, volume and market share increases over the next five year period. These strategies involve an emphasis on full-margin brands in order to maximize profitability. In order to accomplish these goals, existing brand families need to be completed where strategically profitable. Markets underrepresented by PM need to be penetrated, and new market segments which provide benefits to consumers need to be developed. Finally, products which address external requirements facing the industry need to be developed as necessary.

#### **R&D Programs:**

- Domestic Product Development
- Menthol
- Paper Technology/Reduced Sidestream
- Low Tar/High Flavor
- Filtration Research
- Flavors

#### **DEMOGRAPHICS**

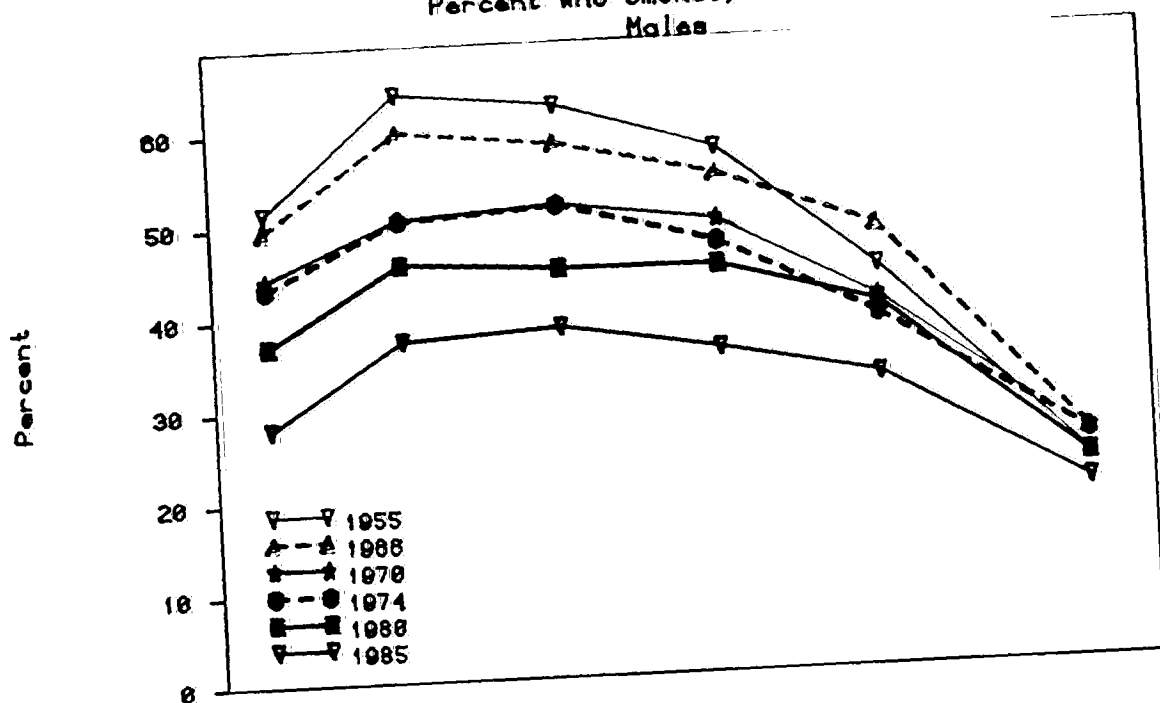
##### **Status:**

Many factors contribute to cigarette consumption decline, and the changing U.S. population is one of them. As the population ages, cigarette smoking declines (Figure 11). Figure 12 shows a population shift that occurred prior to 1990. In the age group 18 to 34, for the first time, the 30-34 year olds dominate. Prior to that date, the 25-29 year old age group was the largest segment. In the 35 and older group (Figure 13), the 35-44's dominate with an increasing 45-54 year old group. An association of smoking trends to this pattern again points to a reduction in cigarette consumption.

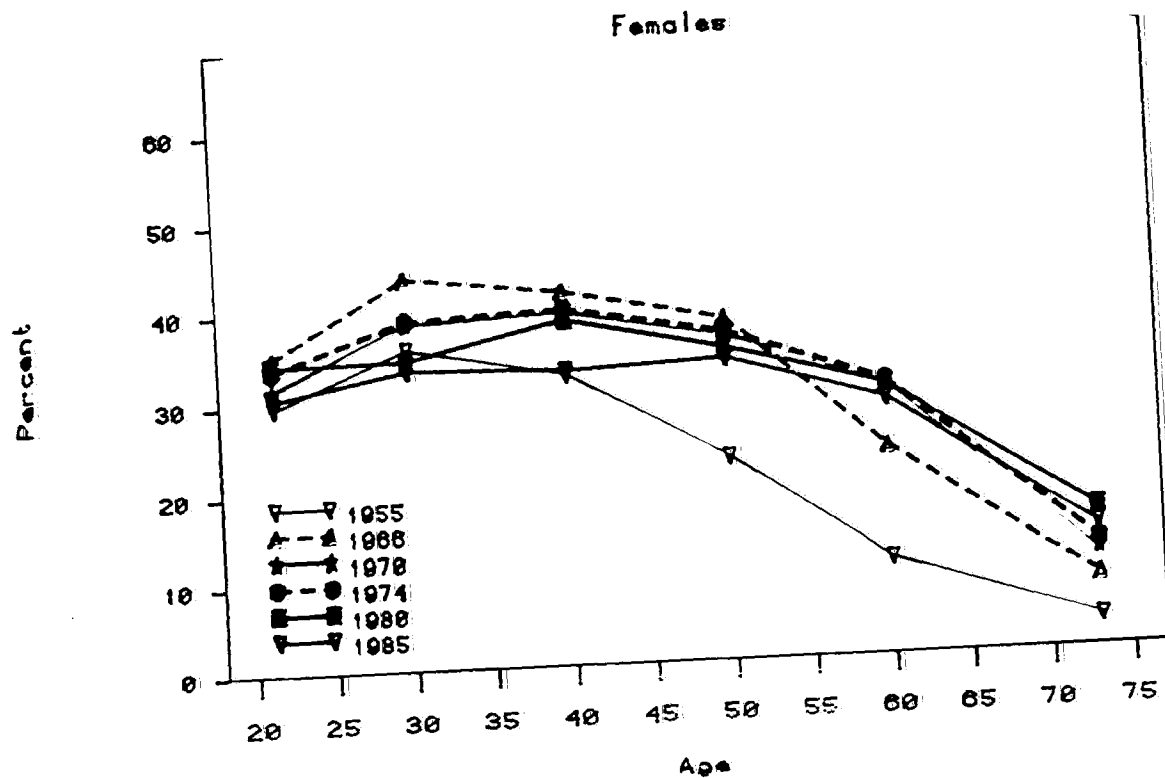
Company share of smokers by age (Figure 14) demonstrates PM's lead up to age 40. RJR has been successful in attracting smokers over the age of 40. These two companies represented a total of 70.4% of the U.S. cigarette market in 1989. American shows growth of share starting with smokers at age 40. The brands which contribute to this growth are in the price value category (Malibu, American Full Flavor and Lights, and Montclair) as well as their Carlton brand. The trends in the price value category (Figure 15, top) over the past three years indicate strong growth in the branded generics. This

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Figure 11  
Percent Who Smoked, 1955-1985  
Males



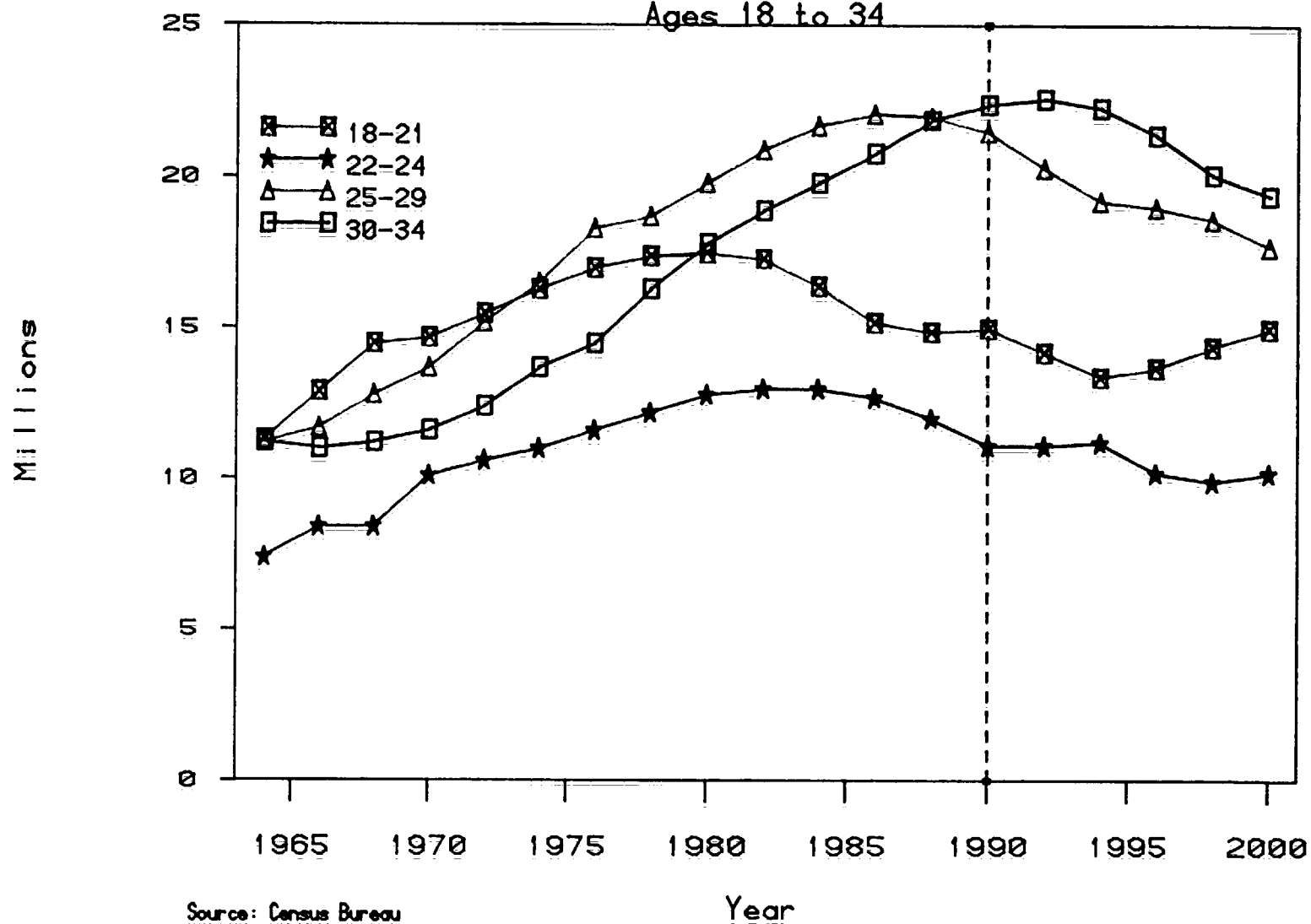
Females



Source: Public Health Service

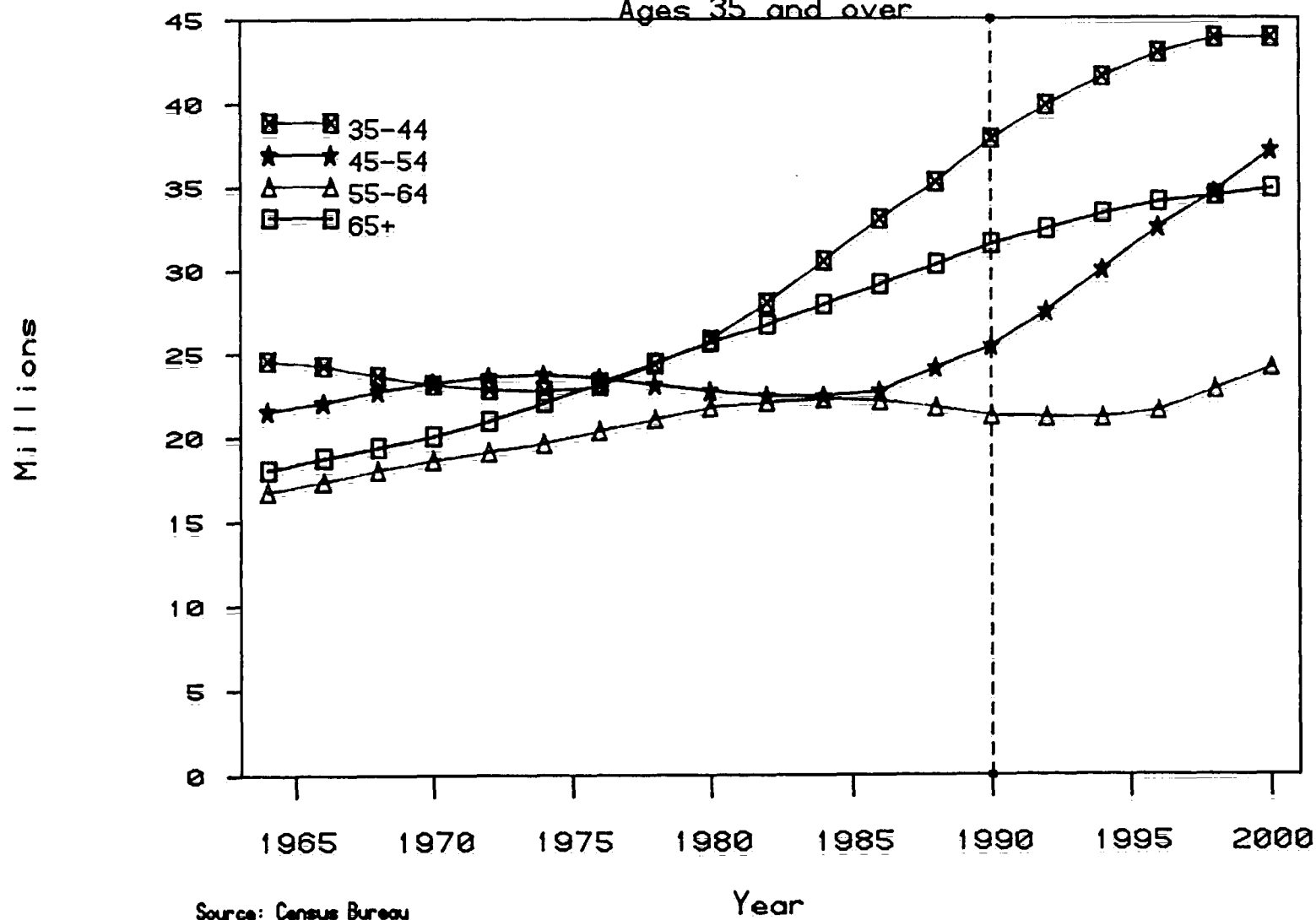
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Figure 12  
Population Estimates and Projections  
Ages 18 to 34



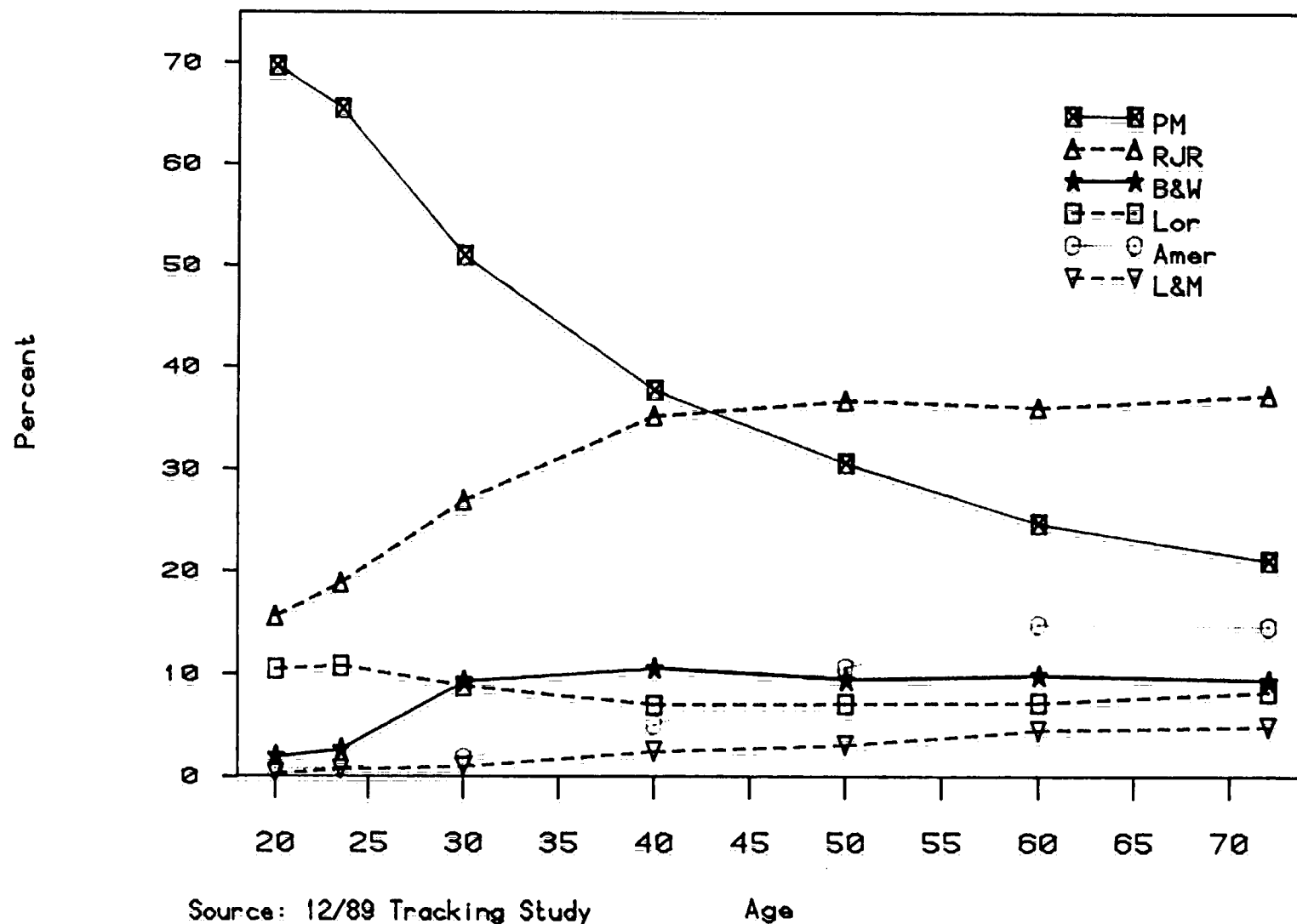
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Figure 13  
Population Estimates and Projections  
Ages 35 and over



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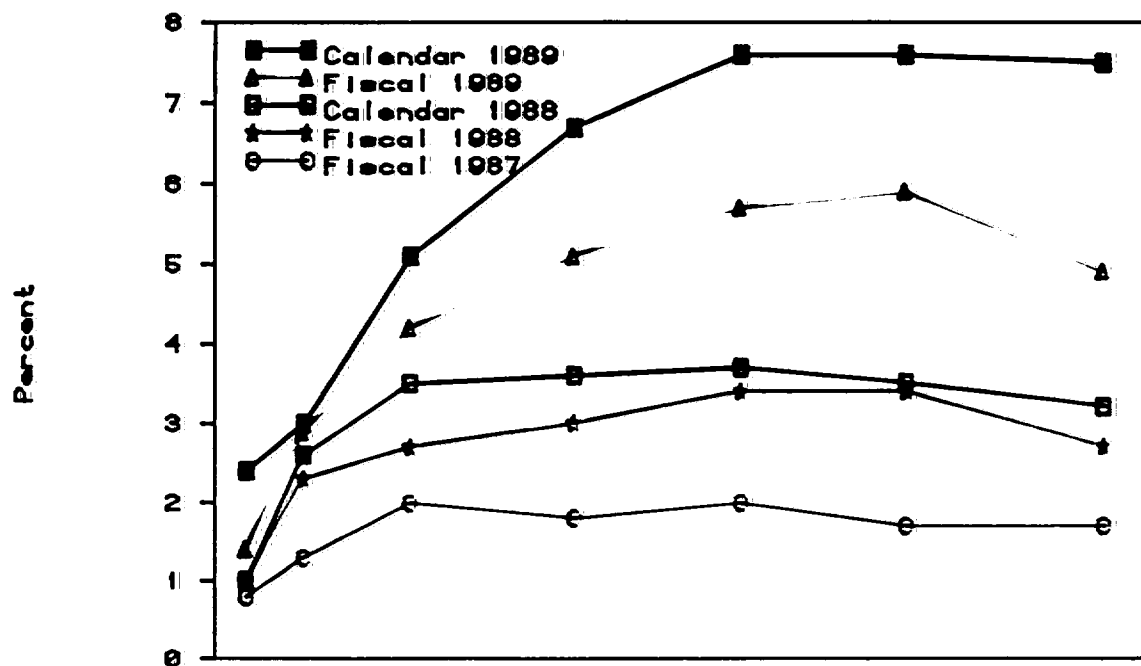
Figure 14  
Company Share of Smokers, by Age



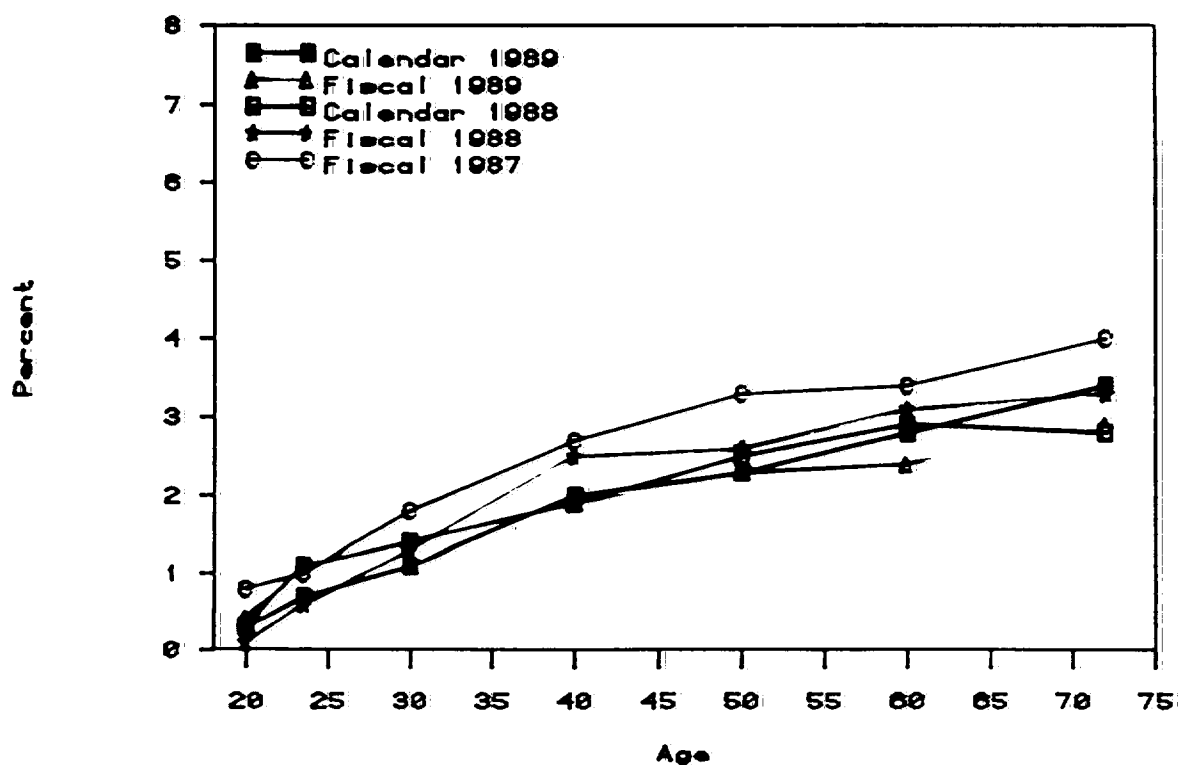
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Figure 15  
Percent who Smoke Branded Generics



Percent who Smoke B&W Generics



Source: Tracking Studies

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trend peaks at age 50 where 7.5% of this age category smoke branded generics. The growth of black and whites peaked in 1987 and has declined since (Figure 15, bottom).

A review of age related trends (Figure 16) shows the full flavor filter category strongest in the 20 and 25 year old groups. At age 30, both the full flavor and flavor low shares are equal, with Flavor Low having less of a decline than full flavor with increasing age. Other than the strength of non-filter among older smokers, the ultra low share increased to just under 20% with older smokers.

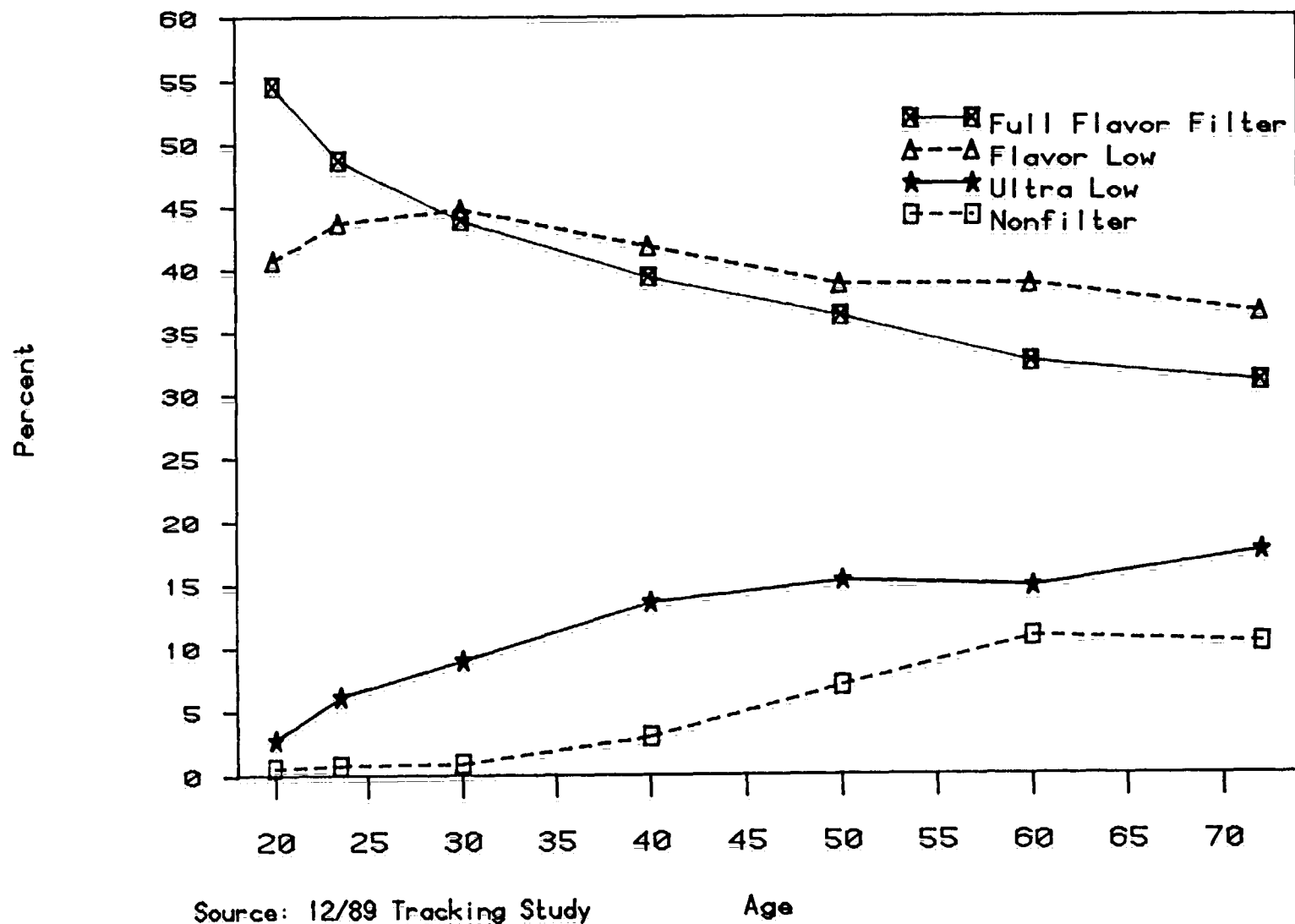
Interesting demographic-related strategies may be derived from the recent data in the Consumer Tracking Study-Year Ending December, 1989. PM's share of male smokers exceeded 40% and PM's share of female smokers exceeded 42% (Figure 17). PM's gain this past year can be attributed equally to men (1.7%) and women (1.7%) smokers. RJR, however, lost equally among both men (-1.5%) and women (-1.8%). With Capri, B&W experienced a slight increase among women smokers (0.2%), but a decline among men (0.9%).

The domestic Hispanic population is increasing as are the percent of Hispanics who smoke and the number of female Hispanics who smoke. PM is well positioned with this segment with Marlboro and B&H (non-menthol). However, PM is not well positioned with respect to Puerto Ricans largely because of our underrepresentation in the menthol category. Responses to the menthol challenge are addressed in the menthol segment section.

A review of Marlboro demographics is also a review of the 18-25 year old age group (Figure 18). In 1989, Marlboro's share of that smoker group was in excess of 60%. The brands strength since 1977 has been in that age group. A chart of P.M.'s share of smokers by age (Figure 19) has the same slope as that of Marlboro (Figure 18). The continued success of this brand depends on keeping its age profile young. This fact then would say that we do not want Marlboro or the Marlboro image to be old. Its success through the years has been its ability to attract the entry smoker. Then at a point in time, around 30 years of age, the smoker will choose another brand. It is important to understand the factors affecting this switch in brand so that we can adequately provide new choices for these consumers. This trend is also important for the life of Marlboro. Marlboro's sales are influenced by four packings: Marlboro Full Flavor Box and Soft Pack, and Marlboro Lights Box and Soft Pack. They all have their largest share among the 20-25 year olds and show a decline with older smokers (Figure 20).

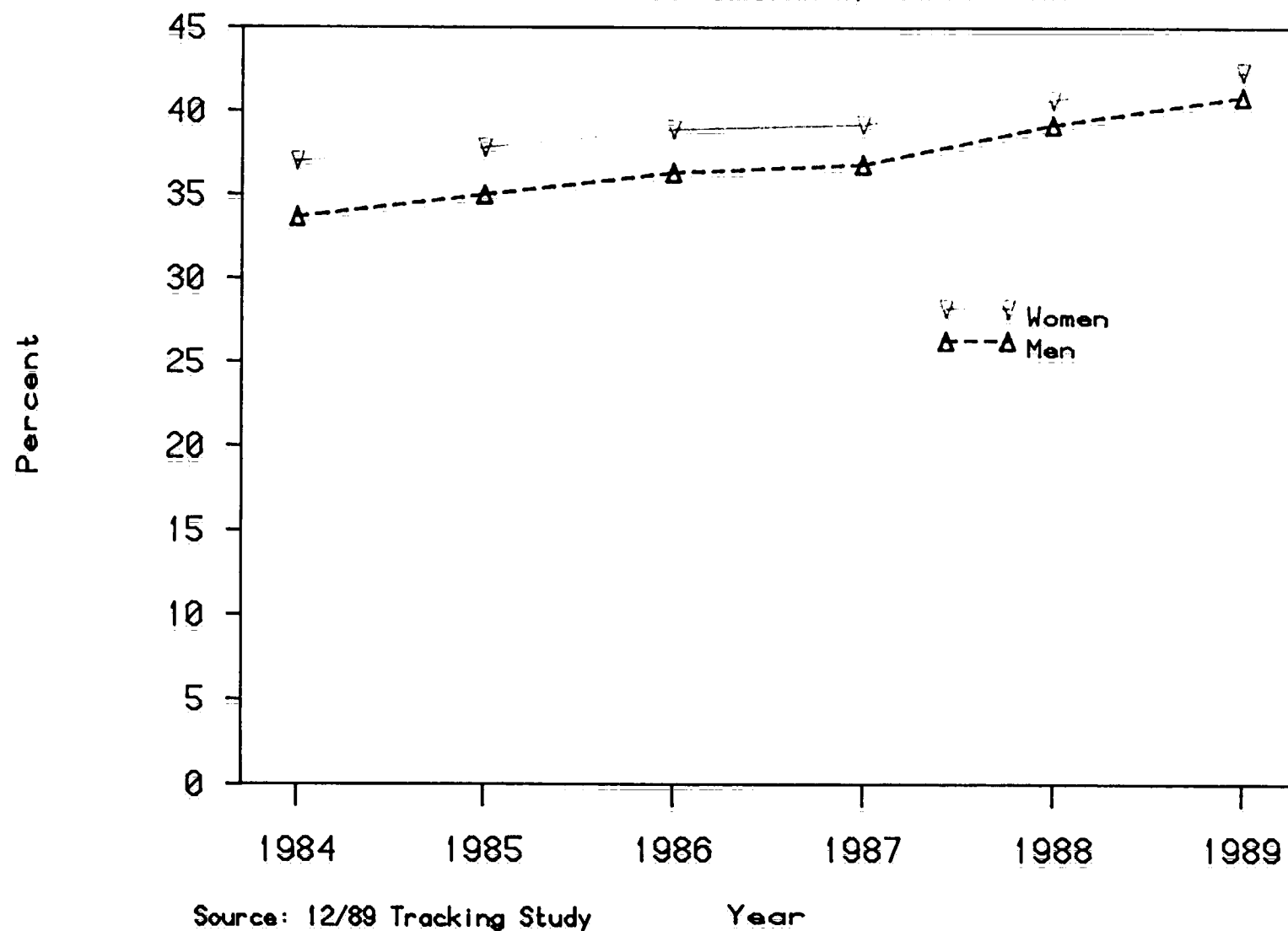
These sales trends suggest several possibilities. The first is to maintain Marlboro as a brand of choice for the 20-25 year olds. The second is to offer a choice to the smokers who are leaving the Marlboro full flavor and lights packings. This is important for two

Figure 16  
Share of Smokers, by Age



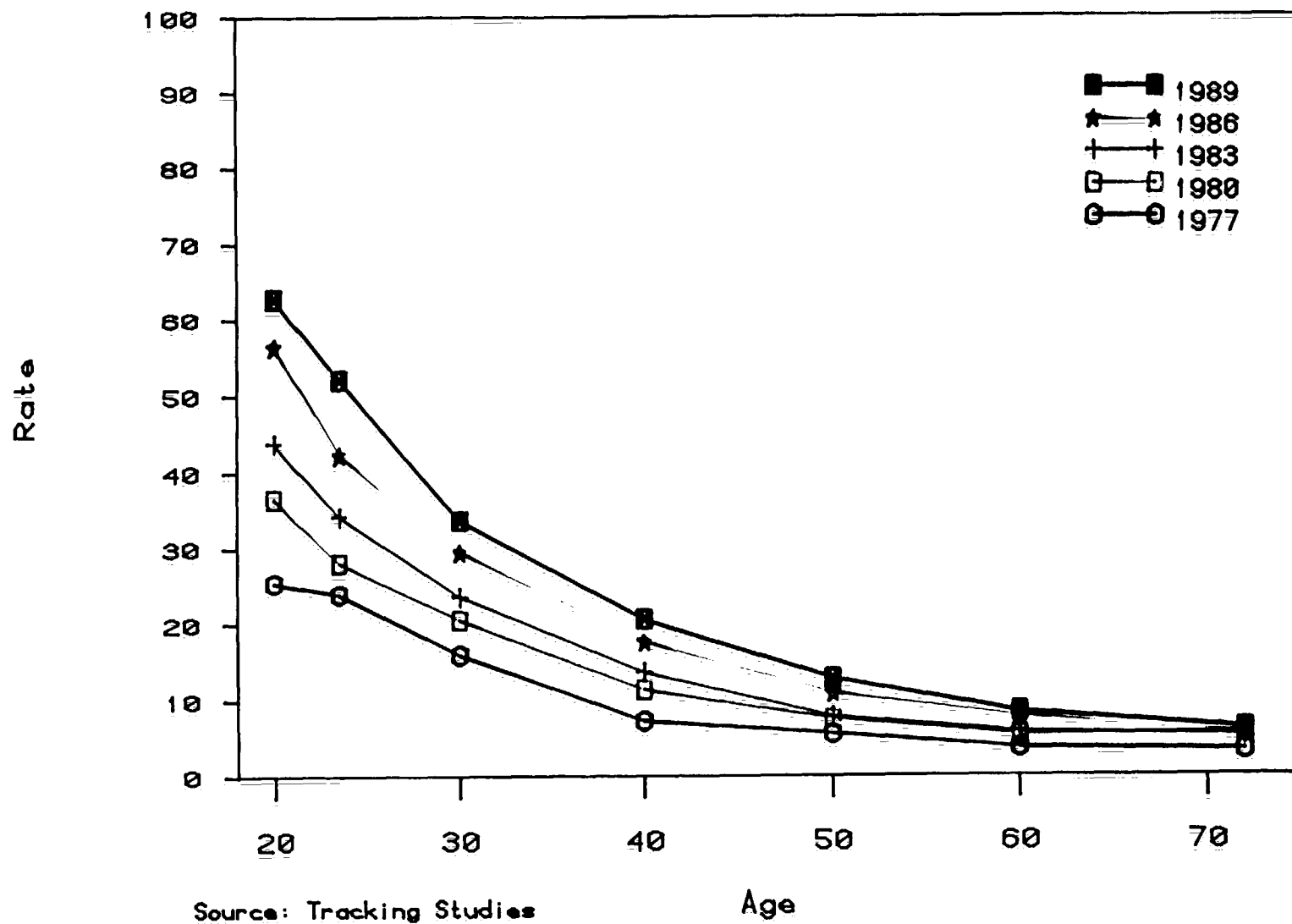
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Figure 17  
PM Share of Smokers, 1984-1989



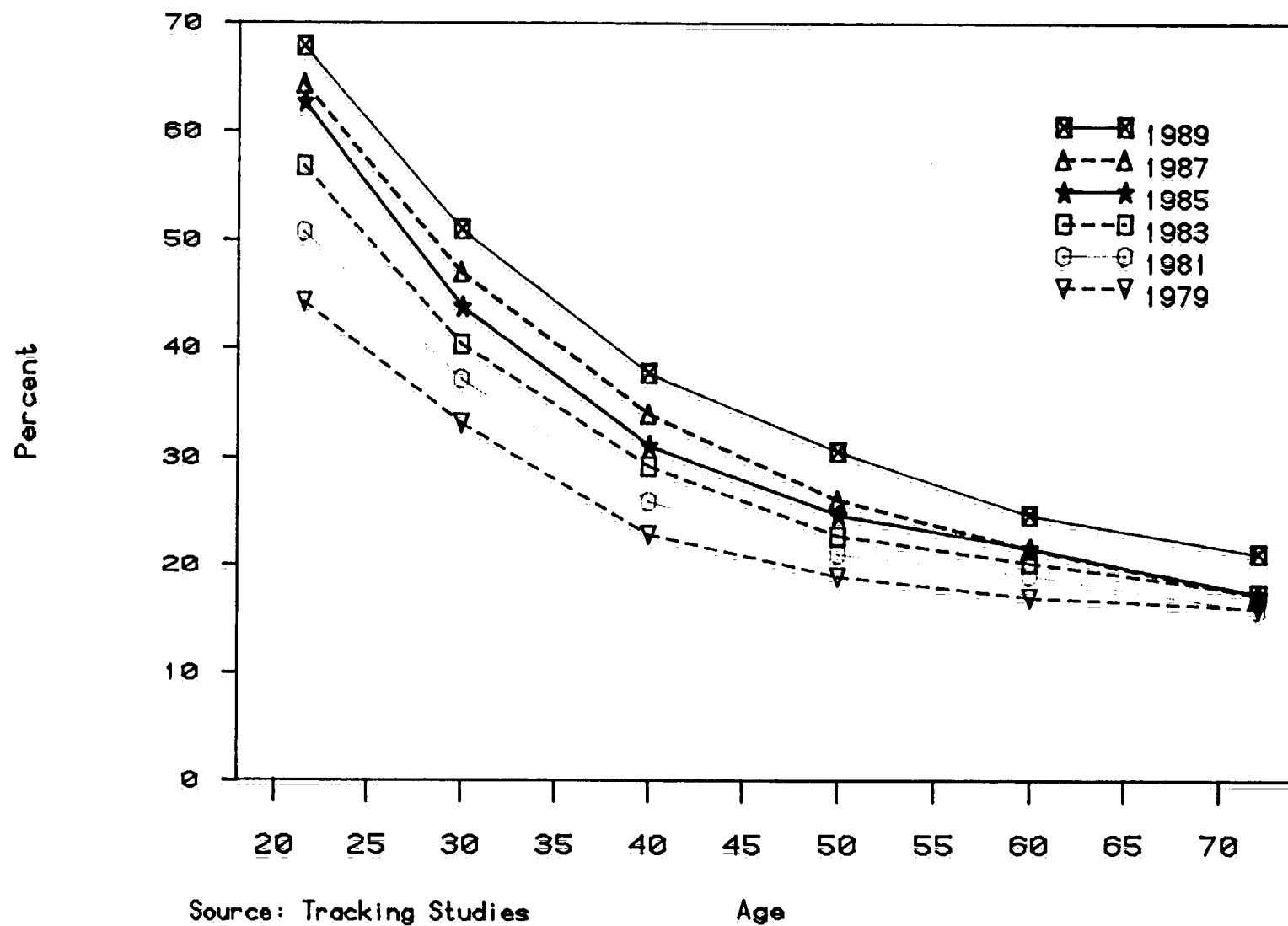
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Figure 18  
Marlboro Share of Smokers, 1977-1989



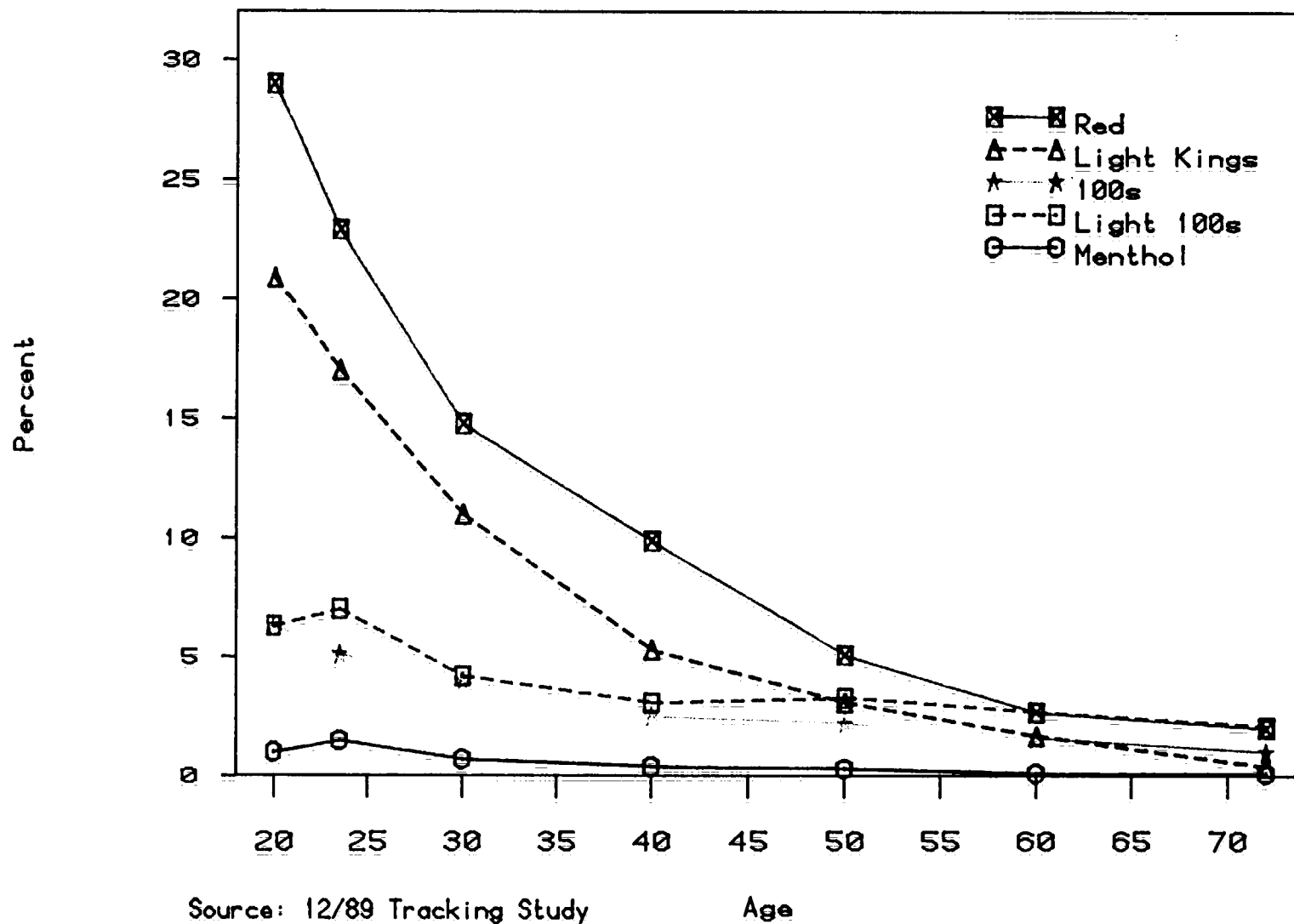
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Figure 19  
Percent Who Smoke Any PM Brand



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Figure 20  
Percent Who Smoke Marlboro, by Age



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reasons. One is to attract the older smoker out of Marlboro, and the second is to keep this smoker within the PM family of brands.

From a competitive standpoint, we must continue to monitor the marketplace and be prepared to counter any inroads by another brand into the 20-25 age group. Camel appears to be threatening Marlboro, particularly in the 18-21 year age group. However, several important facts need to be considered when evaluating this situation. First, Camel appears to be attracting young white males in the western part of the country in the 18-21 age group. The Camel advertising campaign clearly focuses on this segment. Marlboro, on the other hand, remains strong in the 21-25 year group, and appeals to young white males in the eastern part of the country as well as a growing number of young females. Therefore, Camel appears to be capturing a small, declining, and highly specific segment of the market and does not appear to be a general threat to Marlboro at this time.

#### **R&D Response:**

The test market of Marlboro Ultra Lights is a major opportunity. Share trends indicate that lower tar deliveries are more popular with the older smokers. Therefore, an ultra lights Marlboro entry into the market could offer to the older smoker an appropriate alternative. Other products and brand franchises also need to be positioned to attract smokers of 30 years of age and older. Figure 21 shows that currently B&H, Merit, Virginia Slims, and Cambridge tend to attract older smokers.

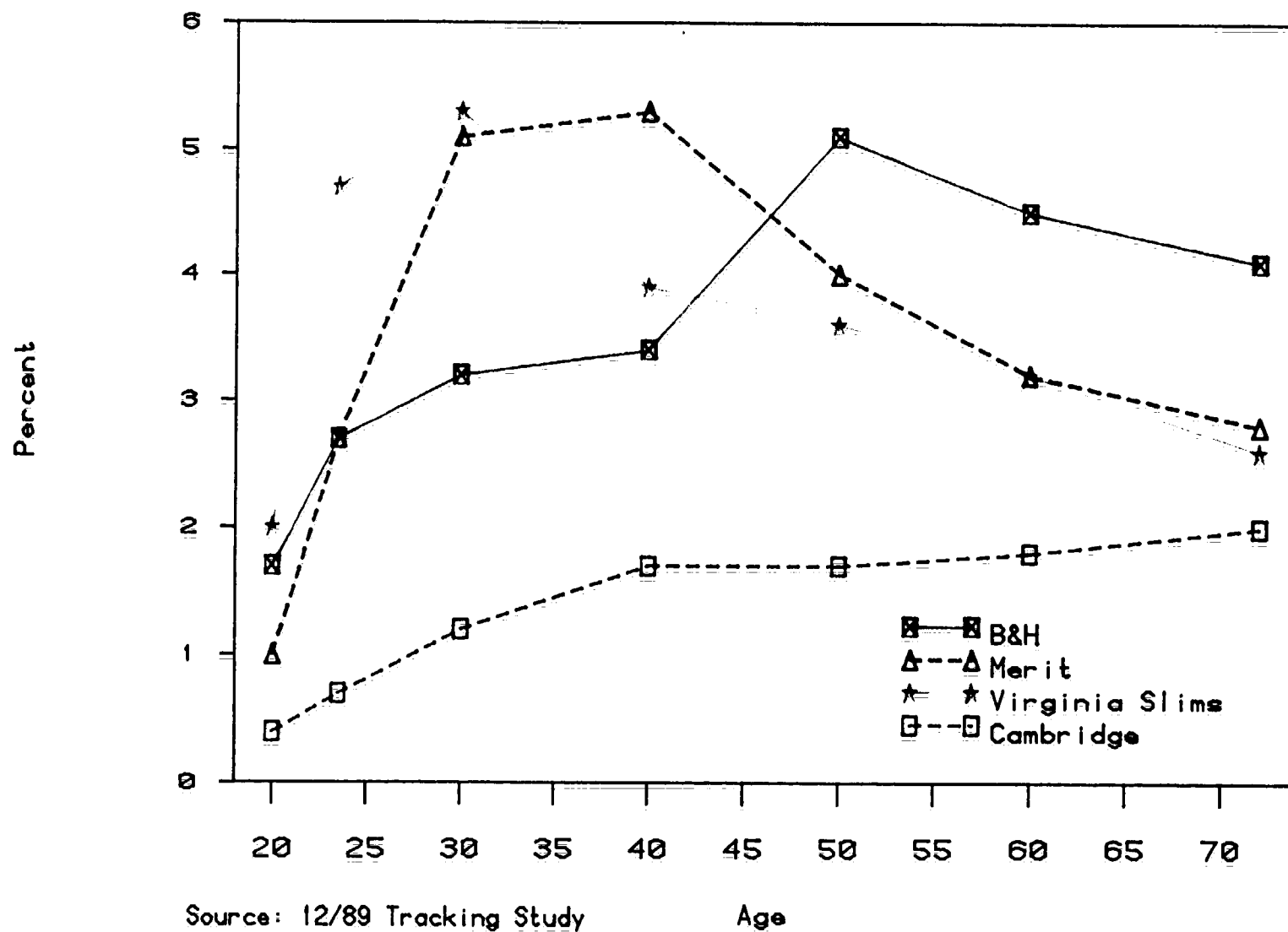
Possibilities include:

1. Extension of the B&H family into a king size packing;
2. Extension of the Merit family into 1 to 2mg packing.  
The Merit family has been successful in the age categories of 30 years of age and older;
3. The possibility of opening up a new category in the market place. That of a nicotine segment with products developed from the Art program. We could offer lower nicotine as well as 1/2 of the nicotine of conventional products;
4. It is evident that older smokers are being attracted to the branded generic category. The continued growth of our Cambridge and Alpine brands, as well as new launches, such as the Bucks brand, will help increase our share in the branded

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Figure 21  
Percent Who Smoke Other PM Brands, by Age



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generics category;

5. Products developed from new technologies, such as low sidestream or altered sidestream odor, could be important in developing new alternatives for the older smoker.

#### **R&D Programs:**

Domestic Product Development  
Project ART  
Paper Technology/Reduced Sidestream  
Project Ambrosia  
Project BOLD-Low Tar/High Flavor

#### **NEW MARKET FOCUSES**

##### **Status:**

Our review of 1989 market activities delivers a message that the market is changing and our competitors are largely responsible for initially changing the market. All of our competitors have entered into the price value category. RJR has opened new segments relating to the social aspects of cigarettes with Vantage Excel and Chelsea. Even our vendors have patented new technology to be used in the manufacture of cigarettes. An example is the Ecusta patent for application of aroma release compounds to cigarette paper. The reality of RJR's Premier is still with us, even though it has been removed from the market. There were problems with the product execution, but not with the product concept. The potential viability of these products is visible to the cigarette industry, and to other industries with expertise in aerosol generation and delivery devices.

The test markets of Next and Merit De-Nic™ clearly open a new technology segment of the market for which PM can take credit. Continued development of the product and other uses of the De-Nic™ process, such as half-nic, give PM a clear advantage in the market place. However, success of these products could lead to other products by the competition in this category. We have also introduced the Marlboro Ultra Lights product into test market. The national introduction of this product will expand this segment. Our Low Tar/High Flavor Program needs to continue to develop products in this delivery range as well as the ultra low tar range that deliver taste at lower tar and nicotine.

### **Likely Scenario:**

Competition in the new product area will continue. 1989 was one of the most active years for new product introductions in recent times. A total of 68 new products were introduced (see Table 16). Given the declining market, that the industry is committed to gaining market share with new introductions. These introductions were not only brand extensions or repositioning into the price/value category, but also products with features which could be conveyed to the consumer by marketing and product performance. This trend will continue as the industry competes for share and volume in the U.S. market. Projections would have Liggett almost nonexistent in the U.S. market, yet with a bold move in the price/value category, Liggett gained in volume and market share.

With a strategy to focus on full-margin trends, PM must follow the price/value category closely and provide superior products which meet the pricing strategies of our competitors. PM, more importantly, must continue to strengthen both internal and external resources essential to the development of innovative new products which address the concerns of our consumers of cigarettes.

### **R&D Programs:**

- Project Sigma and Beta
- Project ART
- Reduced Sidestream/Paper Technology
- Filter Technology
- Project Ambrosia
- Low Tar/High Flavor

### **Alternate Scenario:**

The declining market could accelerate and traditional cigarettes could become less of a factor in the U.S. market. Several factors could contribute to a lack of competition in the U.S. market and less innovation in new products. These include such factors as the buy-out of a tobacco company and the resulting "milking of the business" for maximum profit, and reliance on the price value category for market share with limited investment in innovative new products.

### **R&D Response:**

R&D needs to produce innovative products which will provide benefits to the consumer. Considering our competitors, PM USA is uniquely positioned to take maximum advantage of this strategy. With a growing market share, superb financial base, and lack

of dependence on the price/value category, PM USA has a clear opportunity to best impact the market with innovative products.

### **SOCIAL/POLITICAL FACTORS**

#### **PERCEIVED HEALTH CONCERNS**

##### **Status:**

There have been many papers published in the external scientific literature regarding smoking and health. A large proportion of those papers deal with genotoxicity in cell cultures, laboratory animals and humans. There is some work being published regarding individual differences in susceptibility to the potential effects of smoke. A considerable amount of information on the biological effects of smoke has been published by RJR. Most of the data published by RJR compare the effect of smoke from a cigarette which burns tobacco to smoke from a cigarette which only heats tobacco. There continues to be a lack of studies published which demonstrate the induction of lung cancer in laboratory animals by cigarette smoke.

**Surgeon General's Report** - The US Surgeon General, Dr. Novella, issued a report this year which covered smoking cessation benefits, and sales and health concerns in third world countries, particularly Latin America. The role of the new US Surgeon General as a force in public health smoking concerns has not yet crystallized. Contributing to this lack of a current strong public posture by the US Surgeon General is the prominent position which Secretary of HHS, Dr. Louis Sullivan, has taken in this area.

##### **Likely Scenario:**

As mentioned in previous plans, the purported effects of smoking on health have been extensively publicized. The greatest concern of the public and anti-smoking groups appears to be the health of nonsmokers exposed to environmental tobacco smoke (ETS). The EPA has issued a preliminary document declaring that ETS is a carcinogen. If this document is approved, ETS could be regulated as a workplace carcinogen through NIOSH/OSHA. Legislation has been enacted in Virginia, for example, to limit the places where people can enjoy our products. Additionally, consumer research has indicated that a product perceived to have fewer health problems would be appealing to current smokers if it was subjectively and economically acceptable. Products which address the concerns of the consumer as well as those of nonsmokers would have a positive impact on the industry.

**R&D Programs:**

Project Beta  
Project ART  
Selective Filtration  
Low Tar/High Flavor Program  
Lowered Biological Activity Program  
Tobacco Specific Nitrosamine Program  
Reduced Sidestream Program  
Project PACT

**Alternate Scenario:**

There is one development that would significantly affect the tobacco industry: the clear establishment of a causal link between smoke exposure in laboratory animals and the development of lung cancer. The Lovelace Inhalation Toxicology Research Institute (ITRI) is actively conducting research in this area. Additionally, Dr. R. O. McClellan, the former director of ITRI, is now the director at the Chemical Industry Institute of Toxicology (CIIT). He is in a position to continue and expand the work being conducted at ITRI.

**R&D Response:**

Continue fundamental research on the biological effects of cigarette smoke (mainstream/sidestream). Work should be focused on confirming outside findings and monitoring product changes. This response is being addressed by the Lowered Biological Activity Program and other research efforts conducted under PM USA direction.

If specific compounds in smoke are found which are causally involved in the formation of lung tumors (as noted above, this link is not yet established), work should be conducted to remove those chemicals from smoke. The Tobacco Specific Nitrosamine Program, the Selective Filtration Program, and Project ART are currently directed toward perceived health issues. It is anticipated that the Company will need to increase efforts in this area in the latter part of the plan period.

Develop novel products which produce a significantly different "smoke".

## SOCIAL ACCEPTABILITY

### Status:

The social environment for both smokers and non-smokers has changed due to the anti-smoking media coverage and the display of No-Smoking signs. In this environment, the decision process for the smoker has now changed from one of, *To smoke*, to one of *Not To Smoke*. In a smoker's world there are now more cues not to smoke generated by the number of smoking restrictions in the workplace, shopping malls, restaurants and airports. Through all of this, the emergence of smoking sections may be an advantage to the smoker. Essentially the smoker is looking for a hassle free environment in which to smoke and a way to be less annoying to the non-smoker. However, in addition to this, the smoking section is an obvious visual cue to smoke. This holds true in public places, as well as the work environment. The Smoking Section signage, the presence of ash trays or another individual who is smoking, are all visual cues which contribute to the decision for the smoker to smoke.

Relating the social environment to product attributes pinpoints features of cigarettes which, if altered, would generate less criticism to the smoker from the non-smoker. These features relate to lingering cigarette smoke odor, sidestream odor, sidestream visibility and exhaled smoke.

### R&D Response:

Our approaches to the issues which are developing from social acceptability range from Project Pact for improved indoor air quality to Paper Technology in reducing sidestream visibility. Cigarette development projects aimed at improving odor and visibility of sidestream smoke will be successful if cigarette products developed are acceptable subjectively to the consumers. The social benefits being developed in these programs are important, but consumers will not be willing to give up subjective satisfaction for these benefits.

## SOCIAL TRENDS

### Status:

The work of David Musto (Medical Historian, Yale University) points to the existence of what he calls a "Temperance Movement" in the United States that began in 1980 in response to the drunk driving issue. Musto claims that this is the third temperance movement in the U.S. over the past 200 years, and that these movements are approximately a generation apart (1850, 1920, 1980). All of the movements appear to

be characterized by the recognition of a genuine social problem (the "whiskey glut" of 1850, the destructive effects of Saloons at the end of the 19th century, and drunk driving in 1980). However, these movements have in the past expanded from their roots in real problems to concerns that lead to a destructive effect on individual freedoms. An inability to support the necessary high level of public interest in the issues developed during a temperance movement ultimately leads to their decline. The effect of other people's actions on nonusers or nonparticipants has generally been an effective tool in maintaining public interest. It is inevitable, therefore, that the anti-smoking issue would turn to environmental tobacco smoke.

#### **R&D Response:**

R&D will continue to conduct qualitative research studies involving consumer needs, US demographics and statistical information to assess developments in social trends that may impact our business. In addition, R&D will continue to support historians and behavioral scientists who help our understanding of why people smoke and utilize history to predict future social patterns.

#### **STRATEGIES OF ANTI-SMOKING GROUPS:**

##### **Status:**

Anti-smoking groups are now concentrating on ETS and its effect on the non-smoker. This approach sets up conflict between the smoker and non-smoker. The non-smoker (not necessarily an Anti) now becomes a factor in decisions made by the smoker. The legislative activity was as aggressive in 1989 as it was in 1988, if not more so. The issues continue to be smoking restrictions, restrictions on sampling, sales from vending machines, and establishing a minimum age of 18 for the purchase of cigarettes. In a different light, however, legislative activity was seen in the area of establishing smoking sections wherever no smoking areas are designated and legislation which prohibits discrimination in the work environment towards smokers.

A dramatic result of the anti-smoking groups' strategy was evident during two RJR launches (Uptown and Dakota). The uproar over RJR's attempt to target blacks and women led to the removal of Uptown from the test market.

##### **Likely Scenario:**

Activities by anti-smoking groups are likely to continue both in the social environment of the smoker, as well as on the legislative arena (state and federal governments).

No alternate scenario is anticipated.

**R&D Programs:**

Paper Technology/Reduced Sidestream  
Projects Sigma, Beta  
Project Ambrosia  
Project Pact

**LEGISLATIVE ACTIVITY**

**Status:**

A summary of the 1989 state legislative action is given in Table 24. The number and variety of considered legislative actions makes monitoring and counter actions very difficult. As part of the federal budget deficit reduction legislation passed October 27, 1990, excise tax increases on cigarettes will increase by four cents per pack on January 1, 1991, and another four cents per pack in 1993.

Also, government regulations could indirectly impact the way in which we do business. Examples include: forbidding consumer panel testing, government regulations affecting direct materials (e.g., dioxin in paper), and restricting exports. Legislation on the state level related to prohibiting sampling of cigarettes was passed in Utah. At this time there are no restrictions in consumer testing, and our position is to continue the evaluation of cigarettes with smokers after they have agreed to participate on our POL panels.

**Likely Scenario:**

We can continue to anticipate FTC involvement in the US cigarette marketplace to ensure that new products are properly classified as cigarettes and that advertising claims are justified with respect to product performance and analytical measurements. Tar and nicotine numbers printed on advertising are monitored, and appropriate adjustments are required of the manufacturers. The success of the cigarette export business is receiving attention by the anti-smoking groups with the intention of regulating cigarette exports. This regulation could be in the form of taxes or labeling consistent with requirements in the US market.

Continued pressure will be applied at all levels (federal, state and local) to further limit smokers rights and to pass increases in excise taxes. The federal budget deficit makes a cigarette excise tax increase very likely in 1991. A study of the industry response and impact of anti-tobacco legislation in Canada is discussed in Appendix K. This study is



**Table 24**

**Summary of 1989 State Legislative Action**

**Total Tobacco Legislation (1989)**

Considered:	668
1988	600

**Cigarette Tax Increases (1989)**

Considered:	41 States (27 States in 1988)
Passed:	16 States

**Statewide Smoking Restrictions (1989)**

Considered:	41 States (39 States in 1988)
Passed:	16 States

**Cigarette Advertising Restrictions (1989)**

Considered:	7 States
Passed:	None

**Cigarette Sampling Restrictions (1989)**

Considered:	15 States
Passed:	1 (Utah)

**"Fire-Safe" Cigarette Legislation**

Considered:	4 (Ma, Mn, NY, Wi)
Passed:	None

Will continue to be a major challenge over the plan period.  
Federal legislation will take precedent.

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**Table 24 (continued)**

**Summary of 1989 State Legislative Action**

**Sale of Cigarettes to Persons Under 18 Years of Age**

Considered:	22 States
Passed:	4 States

**Vending Machine Legislation**

Considered:	12 States
No Specific Legislation Passed	

**Legislation Which Prohibits Discrimination Practices Toward Smokers**

Considered:	10 States
Passed:	2 States

During 1990 five additional states passed employment discrimination legislation to protect smokers in employment.

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notable since anti-tobacco legislation in Canada is ahead of the US, and there is potential for a scenario similar to the one in Canada.

**R&D Response:**

Develop products and processes which address the concerns of the smoker and non-smoker.

Develop products which are news worthy to counteract advertising restrictions.

**R&D Programs:**

Paper Technology/Reduced Sidestream  
Project Sigma/Beta  
Project Ambrosia  
Project PACT

**Alternate Scenario:**

State and local smoking restrictions and increases in excise taxes will diminish somewhat as more important national issues rise to the surface (e.g., environment, federal budget, world conflict).

**REGULATION OF INGREDIENTS**

**Status:**

The six major cigarette manufacturers in the United States have provided five composite qualitative ingredient lists to HHS as required by law. The next list is due in December of 1990. A report on ingredients from HHS is not expected during 1990. HHS Secretary Sullivan's position on whether it will occur in 1991 is uncertain at this time. In 1990, the six major cigarette manufacturers provided HHS with actual poundage for each ingredient used in 1989. This was done voluntarily. Two bills are pending in the US Congress that deal, in part, with ingredients. The Waxman/Whittaker and the Kennedy bills are proceeding through different parts of Congress. Both are still in the formative stages; however, some meetings/hearings have already taken place. Some of the significant issues which both proposed pieces of legislation deal with include advertising practices, sales to minors and non-tobacco ingredients. In addition, regulations on ingredient labeling and safety evaluation information could result. New federal administrative offices could be set up to regulate ingredients in cigarettes.

Around the world ingredient regulations are emerging rapidly. Some deal only with warning labels. This is the case in the Netherlands and Norway. Canada requires ingredient/disclosure by brand. The following countries regulate non-tobacco ingredients in cigarettes: Austria, Belgium, Denmark, Finland, France, Germany, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, Yugoslavia, Egypt, South Africa, and Tanzania.

#### **R&D Response:**

An extensive review of ingredients has been underway at PM for the past four years. From 1986 to 1989 the number of ingredients utilized for all PM USA products has been decreased by 28%, while the tobacco industry has reduced the number of ingredients by only 19% in that same period of time. If labeling becomes necessary, a distinct advantage will be realized logistically with the fewest number of ingredients. Requests for additional information and/or elimination of ingredients may result in a significant impact on the resources of the Analytical and Biochemical Research Divisions as well as Flavor Development. In addition, work is ongoing to replace synthetic ingredients with natural ingredients where appropriate. Work to replace natural ingredients with synthetic ingredients may be warranted if the non-specific nature of most natural ingredients presents a problem and/or product quality is affected. Due to the need to maintain ingredient information proprietary for each brand, it is essential that this issue be handled at the industry level. Therefore, any problem that may surface with a tobacco industry ingredient would need to be addressed by all tobacco companies.

Our involvement in legislation and/or compliance activities will continue. Evaluation of ingredient safety and quality through consultants, literature and experimental investigation will remain at a high level of activity. The development of new products which meet or exceed pending or proposed legislation remains a strong area for R&D involvement.

#### **R&D Programs:**

- Ingredients
- Flavor Specifications
- Alternate Flavor Systems

## REGULATION OF SMOKE CONTENT

### **Status:**

Government regulations with respect to labeling requirements and limitations on tar, nicotine and CO levels continue to emerge in international markets. Japan now requires tar and nicotine labeling on product packs. Other regulations are listed in Table 25.

### **Likely Scenario:**

Regulations by foreign governments can be expected to increase. These restrictions will significantly impact the direction of future product development strategies. In addition, the possibility of U.S. federal government restrictions on export cigarettes exists.

### **R&D Program Response:**

Compliance with regulations and restrictions.

New product development programs which utilize new technology that will assist in achieving compliance with all regulations:

- Project ART
- Filtration Research
- Paper Technology/Reduced Sidestream
- CO Catalysts Studies

## IGNITION PROPENSITY

### **Status:**

Senators Moakley and Boucher reached a compromise on a fire safety bill. This bill is a significant improvement over previous drafts in that it does not provide for a performance standard. The bill, called the Fire Safe Act of 1990, was signed into law and will require the following:

Consumer Product Safety Commission (CPSC) directs National Institutes of Standards and Testing's (NIST) Center of Fire Research to:

Table 25

## Government Regulation of Tar, Nicotine and CO

<u>Country</u>	<u>Printed Parameters</u>	<u>Maximum Allowed Deliveries</u>
Bahrain	Tar, SN	Tar = 12mg SN = 0.8mg
Kuwait	Tar, SN	Tar = 12mg $\pm$ 20% SN = 0.8mg $\pm$ 20%
Oman	Tar, SN	Tar = 12mg SN = 0.8mg
Qatar	Tar, SN	Tar = 15mg SN = 1mg
Saudi Arabia	Tar, SN	Tar = 12mg SN = 0.8mg
Singapore	Tar Banding	Tar = 15mg $\pm$ 15% SN = 1.3mg $\pm$ 15%
Hong Kong	Tar Banding	None
Japan	Tar, SN	Printed Tar $\pm$ 20% Printed SN $\pm$ 20%
Australia	Tar, SN, CO	Voluntary Code: Tar = 14mg SN = 1.4mg CO = 20mg

SN = Smoke nicotine.

Tar Banding = Language specified for various tar ranges.

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Develop a standard test method to determine ignition propensity;

Compile data for cigarettes using the developed test method; and

Conduct laboratory studies on computer modeling of ignition physics to develop valid user-friendly predictive capability.

**CPSC will:**

Initiate study to collect baseline and follow up data about characteristics of cigarettes, products ignited and smokers involved in fires.

**Health and Human Services and CPSC will:**

Develop information on changes in toxicity of smoke and resultant health effects from modified cigarettes and societal costs of cigarette-ignited fires.

**Advisory Group - Same as Tobacco Study Group from the 1984 Cigarette Safety Act will:**

Hold hearings to develop information to carry out its functions; and

Advise and work with CPSC and NIST.

**Reports required once funds are appropriated for this bill:**

13 Months -- CPSC and Advisory Group Report to Congress.

25 Months -- CPSC and Advisory Group Report to Congress.

36 Months -- Final Report by CPSC and Advisory Group to Congress.

**Likely Scenario:**

This federal legislation will take precedence over state legislation and halt state initiated legislation on this issue. The result of this is positive, since a more uniform approach to the issue is assured.

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Later in the plan period ignition propensity issues could take center stage and new legislation requiring testing would require a rapid response in terms of introducing new products which meet these new standards.

#### **R&D Response:**

The development and testing of low ignition propensity model cigarettes will continue during the plan period. Interactions will continue to occur between industry and governmental officials regarding this legislation.

#### **R&D Programs:**

Project Tomorrow  
Paper Technology Program

### **ENVIRONMENTAL ISSUES**

#### **Status:**

National and international focus continues to shift from emphasis on controlling and treating industrial emissions and discharges to preventing their generation. The increases in federal and state regulations and public awareness of the environment will intensify during the plan period. The risks of not responding appropriately are enormous. They will affect our manufacturing flexibility and the public's perception of our status as a responsible corporate citizen.

Congressional changes in this area (e.g., Clean Air Act) will be costly to both the industry and the general citizen. As landfills continue to decline in terms of numbers, capacity, and the materials accepted for disposal, costs will rise dramatically. As part of any plan for the future of waste management, recycling of waste and increased use of recycled materials will intensify.

PM USA is currently developing and implementing a five-year plan dealing with the significant issues in the environmental area. Not only do we comply with emission/disposal regulations where they exist, but also we try to foresee the direction in which new regulations are going and prepare for their implementation. These efforts will require additional resources as this entire area of environmental concern moves through this plan period.

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### **Likely Scenario:**

More stringent regulatory standards will be set, greater public awareness and activism will be apparent, and industrial waste management programs will be placed under greater scrutiny.

### **Alternate Scenario:**

Restrictive legislation will come quicker than anticipated at both state and federal levels so as to severely limit our manufacturing flexibility. Businesses which supply many of our materials will be unable to meet tolerance levels for important criteria standards, or in meeting these standards the quality and machinability of these products will be sufficiently different so as to adversely affect our manufacturing efficiency.

### **R&D Response:**

R&D will participate in and provide both guidance and analytical expertise in support of the proposed Environmental Health and Safety Five-Year Plan. A copy of the draft of this plan is in Appendix L. Analytical Research and Biochemical Research will continue to provide laboratory support for non-routine evaluations. R&D will continue to facilitate the operations of the Materials Evaluation Program directed from Quality Assurance with both analytical support and toxicological expertise. The use of R&D expertise is dedicated towards the continued support and initiation of new processes/products which in the production mode comply with all current environmental regulations, e.g., alcohols (Project Grain), phosphate and nitrogen waste discharge (Cast Leaf Program), water column nicotine disposal, volatile organic compounds (VOCs), liquid flavors on RL, CO<sub>2</sub> (New Expanded Tobacco Program), solid waste utilization and recycling (sludge), and ETS management (Project PACT). The use of environmentally neutral packagings and other materials that would allow us to produce quality products is an area being studied, e.g., recycling of paper wastes, use of recycled materials, and "biodegradability."

### **R&D Programs:**

#### **New Expanded Tobacco Program**

- Minimize CO<sub>2</sub> and loss of volatile organic compounds.

#### **Cast Leaf Program**

- Minimize phosphates and nitrates in the process effluent.

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#### Liquid Flavors

- Minimize size thickening to eliminate need for solid waste disposal.

#### Volatile Organic Compounds (VOC)

- Minimize loss of VOCs in our processes.

#### Nicotine Disposal

- Develop methods of handling and dealing with nicotine disposal.

#### Phosphine Fumigation

- Eliminate need for phosphine fumigation by implementing Kabat® treatment.

#### Waste Disposal

- Minimize solid waste disposal (sludge recycling).

#### ETS/Project PACT

- Develop technology that will permit smokers and non-smokers to inhabit smoking areas without irritation to either.

### PACK TAMPERING

#### Status:

An incident of product tampering is feasible and would have major impact on the company. Should such an event occur, a crisis management team would direct the company's response. R&D would be called on for factual information about the chemical nature of the tampering and its impact on a smoker.

#### R&D Programs:

Currently R&D maintains an active materials evaluation program and supports the customer complaint committee. Support of these activities requires the capability of evaluating the impact of foreign additives to cigarettes.

With regard to the development of tamper evident flexible packaging, R&D maintains an awareness of vendor activity. Since packaging is an issue facing all consumer products companies, this particular issue affords much opportunity for synergy among PM Companies.

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## **TECHNOLOGICAL FACTORS**

### **EXTERNALLY DEVELOPING TECHNOLOGIES**

#### **Status:**

Areas of science and technology which are developing rapidly in the technical community *external* to Philip Morris and which will impact our operations during the Five-Year Plan period are discussed in Appendix D. These items were identified by the R&D Principal and Associate Principal Scientists/Engineers. More detailed discussion was then provided by senior R&D personnel familiar with each particular area.

#### **Likely Scenario:**

New technologies are essential to the development of new products and processes which address the areas discussed in this section on future factors. These technologies are important not only to the creation of the product or process, but also to the proprietary position of the company in the industry. Because of the importance in recognizing and evaluating new technologies and their applicability to our product, technology assessment must be accomplished by PM R&D personnel working with outside resources. Therefore, the development and maintenance of outside contracts and resources is essential in maximizing our utilization of technological advances. Within the plan period, important technological advances which would generate a distinct product advantage are likely.

#### **R&D Programs:**

The Technology Assessment Group functions to recognize (with assistance from all R&D professionals) and evaluate technologies which could be utilized to benefit our position in the industry. An Action Plan is outlined in Appendix P on a new technology review mechanism.

### **STRATEGIC TECHNOLOGIES**

#### **Status:**

During the first and second quarters of 1990, the Principal and Associate Principal Engineers and Scientists met as a committee to define the science and technology needs of the current R&D programs. The process employed is summarized below. The strategic needs which should be considered during R&D planning processes are detailed in Appendix E.

Information was gathered by teams who met individually or in small groups with the coordinators, project leaders and/or senior staff of each major R&D program. The objective during these discussions was to determine:

1. Program Needs                      What does the program need to accomplish in order to meet its goals?
2. Science & Technology Needs    What specific technology or areas of scientific investigation are needed to support each program need?
3. Status                                What is the status of each of the above science and technology areas at PM R&D and elsewhere?

Each team prepared a written outline of its findings. These materials were reviewed by the Principal and Associate Principal Staff as a group. The group reached a general understanding of each program need, added science and technology items which it felt were important and, finally, selected the specific items which it believed:

1. Were of strategic importance to the major R&D programs, and
2. Were not well established at R&D.

The group also considered the availability of each strategic item in the external (to PM R&D) world. These were classified as (A) readily available outside, (B) emerging or developing outside, or (C) not available (to any significant extent) outside. It should be noted that availability outside of R&D generally does not eliminate the need for internal efforts to develop or adapt the item to our needs.

The "Strategic Technology Lists" are presented in Appendix E.

Table I lists the strategic science and technology items by Major R&D Programs.

Table II lists, by science or technology item, the items which are important to two or more R&D Major Programs.

The two broad areas of research mentioned most frequently were "Chemical Senses" and the "Chemistry and Physics of Smoke Formation." Chemical Senses research would encompass the development of a fundamental understanding of those physical/chemical and biological system interactions that result in a favorable subjective response to the

product. The senses of primary interest include taste, olfaction, feeling (e.g., trigeminal) and vision. The role of cognitive factors (e.g., consumer expectations) as they impact these senses is also of interest. More specific topics would include single compound design, prediction of response to mixtures of compounds, sensory receptor mapping, experimental work on the cognitive components of perception, study designs, statistical testing and hypothesis evaluation. The Chemistry and Physics of Smoke Formation involves the basic physical and chemical processes by which tobacco is transformed (through pyrolysis, combustion and condensation) into smoke. Each of these areas was perceived by the Program Coordinators and by the Principal and Associate Principal Staff as having significant potential for long-term contributions to the R&D programs.

#### **Likely Scenario:**

The continued financial success of our business will rely to an ever increasing degree upon our understanding of the chemical senses, combustion research and other strategic technologies and the application of this information to the design of new products. The consumer's demands or government's requirements for new, nontraditional products (e.g., low sidestream, decreased ignition propensity, non-burning article, novel aromas) cannot be met solely with the tools which we have successfully used in the past. Successful development of novel products demands additional, innovative approaches.

#### **R&D Response:**

Strategic technologies will be identified and evaluated through a continuing process like the one outlined in Appendix P. Technologies determined to be important to our future success in any given program area will be handled in one or more of the following ways:

1. The Technology Assessment Group will evaluate and monitor the technology;
2. The technology will be incorporated into our basic research support area, and internal resources will be allocated to the technology;
3. A specific technology may become a major program, depending on the number of resources allocated and the stage of implementation the technology has toward new product development.

A discussion of PM R&D implementation of the Chemical Senses and Combustion Physics and Chemistry technologies appears in the Implementation Section of this plan.

## **INTERNAL ENVIRONMENT FACTORS**

### **TECHNOLOGY MANAGEMENT**

#### **Status:**

The objective of technology management is to develop the appropriate resources to provide an environment in which technology-driven products can be developed to grow our business. Technology management has been identified as an internal issue, as the management of technology and technological personnel will be a key factor to our success in the future.

#### **Likely Scenario:**

New technologies will develop rapidly, and technology assessment and evaluation methods will need to keep pace with the change. Personnel skill needs will also change rapidly, making highly trained worker skills obsolete in a relatively short period of time. Adequate training programs will need to be instituted to maintain skill competence in rapidly changing areas. In addition, utilization of outside sources of technology will need to be maximized to obtain key technologies without having to internalize expertise in the area. Intellectual property rights will become more important as novel technology-driven products become commercialized. Technology transfer involving effective communication among Research, Development, Engineering, Marketing, and Manufacturing will be essential to the successful commercialization of these novel products. Finally, as is widely publicized, the lack of availability of trained scientists in future years is expected to become a major issue for the country and the company. In certain disciplines, competition may be fierce, and defense-related skills may be preferentially acquired by the government.

#### **R&D Response:**

The Technology Assessment group and senior technical staff play a key role in the identification and evaluation of key technologies. Our utilization of external resources has dramatically increased in the past few years, and mechanisms are in place to deal with these relationships effectively. External resources have included suppliers, professional services, universities, consultants, purchased services, and synergy with other PM Companies. In order to handle these relationships and our intellectual property rights, another patent attorney has been added to our corporate legal staff. Action plans relevant to technology transfer are discussed in the Implementation Section and in Appendix P. These action plans include technology evaluation mechanisms,

recruiting and science education commitments, personnel training, and communication mechanisms important to technology transfer.

## **R&D RESOURCES**

### **Likely Scenario:**

All likely scenarios indicate a need for an increase in R&D effort. Therefore, if a constant head count is maintained, R&D's ability to implement the plan and address these future factors will be hampered. In addition, the mix of skills of the work force will be required to change in order to develop technologies for future products. Opportunities, including continuing education, broadening reassignments, and additional training, will need to be made available to new and existing employees in order to obtain and maintain the work force necessary to carry out the plan in future years. Specific issues include the availability of individuals trained in certain technologies, as well as the availability of US citizens to handle sensitive defense-related technologies. In addition, it is highly unlikely that existing facilities and equipment will be able to adequately support novel product development or eventual manufacturing.

### **R&D Response:**

Address needs for additional resources by first examining priorities and shifting personnel when feasible. Increase head count in appropriate areas after careful consideration of all possible alternatives. Determine the relative advantages of carrying out a specific piece of research or development work utilizing outside or in-house resources. Outside resources can be used advantageously when a) the project will be of short duration; b) it would require too great an investment in either facility or people resources to conduct the project in-house, or c) a feasibility study is necessary before a decision can be made as to whether or not we intend to seriously commit resources to a program.

Develop action plans to address the projections of a changing work force and the potential shortage of technical personnel with programs designed to attract and motivate employees and improve overall efficiencies. For example, a post-doctoral program at R&D would allow individuals who were recently trained in a specific technical area to transfer and apply that technology to R&D issues on a short-term basis. This would have several advantages. First, R&D would not have to make a long-term commitment to an individual in order to obtain key technical input. Secondly, the program would support and encourage individuals with skills in needed areas, as well as provide a trial period for the evaluation of potential permanent employees.

Design and construct necessary equipment and facilities as needed. An R&D facility plan is discussed in the Implementation Section and in Appendix P.

## CAPACITY

### **Status:**

In 1990, ET capacity was determined to be a significant issue (Figure 22). Plans to add capacity at Cabarrus will satisfy ET capacity needs during this plan period. Additional RCB capacity is also an issue during the plan period. R&D's Cast Leaf program is designed to address capacity needs as well as environmental and flexibility needs associated with the process. Other R&D activities in this area will include consolidation of product components and primary improvement work designed to simplify primary processing and enhance flexibility.

### **R&D Program:**

- Cast Leaf Program
- Consolidation of Product Components
- Primary Improvement

## MANUFACTURING SUPPORT

### **Likely Scenario:**

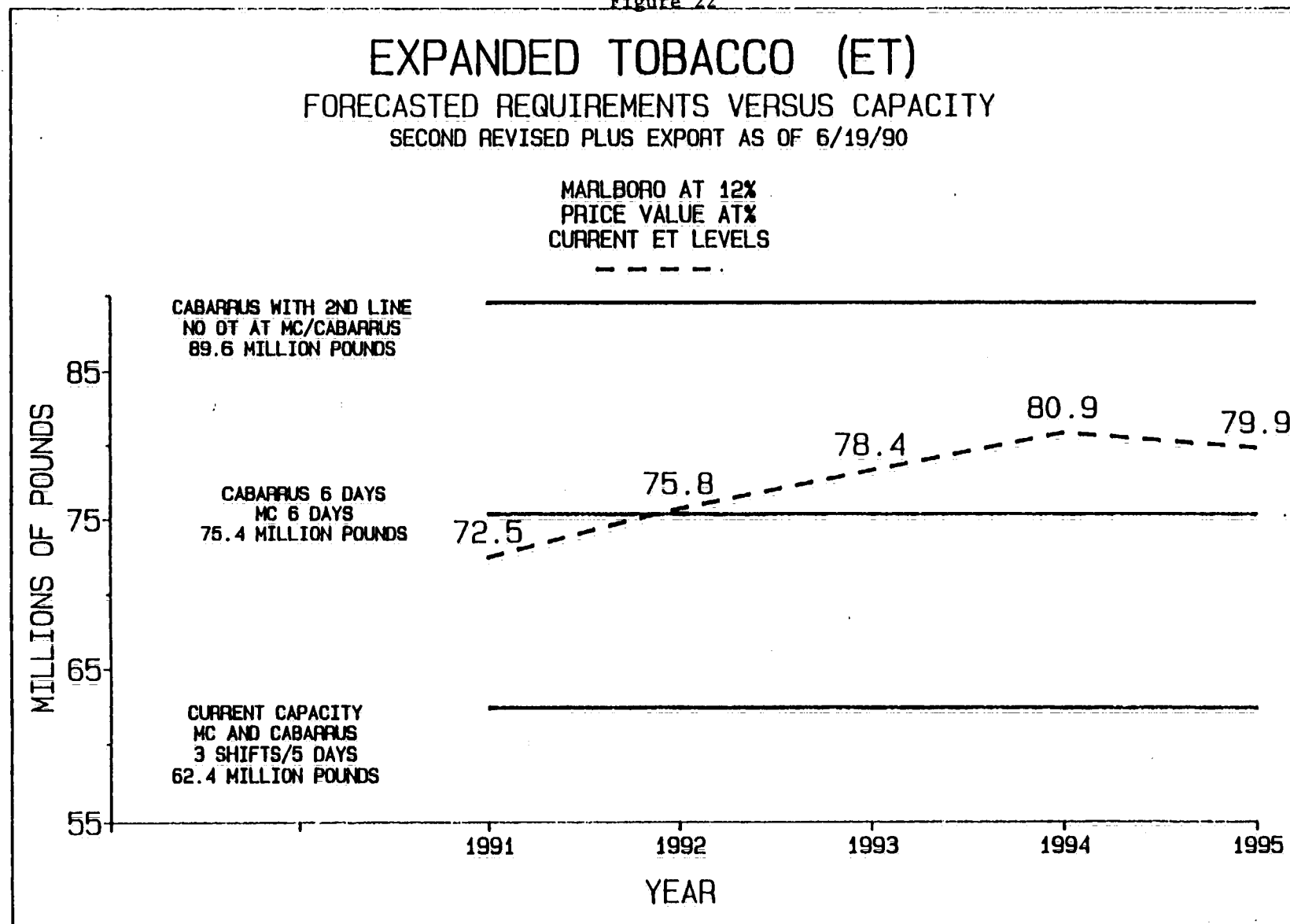
The new manufacturing equipment which can achieve speeds up to 10,000 cigarettes/minute will require R&D support in order to deal with deficiencies in materials. Certain components, particularly papers and adhesives, may not perform optimally at these high speeds. New technologies (e.g., supercritical extraction) and products could increase the need for R&D support of manufacturing. The achievement of PM USA's plan volume objectives will be dependent on a significant increase in brands and new products using new technologies and manufacturing techniques.

### **R&D Response:**

Continue programs which address manufacturing support. These include areas of paper technology, adhesives and optical processing. Develop joint programs with Manufacturing and Engineering to address needs of the future.



Figure 22



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## RAW MATERIAL SUPPLY

### **Status:**

Situations could develop which would result in: (1) shortages of raw materials; (2) necessary modifications to raw materials; (3) key suppliers going out of business; (4) unfavorable business relations with suppliers.

### **Likely Scenario:**

New products and processes continue to be an essential part of our business. The need for new technologies and materials increases the importance of the maximum utilization of our suppliers and their resources. In addition, with increasing emphasis on environmental concerns, suppliers are finding it necessary to modify materials to meet PM and/or government restrictions. Some suppliers may go out of business if unable to meet the new requirements.

The EPA has tightened restrictions on the levels of volatile organic compounds which can be released into the atmosphere. This has resulted in a push toward waterborne lacquers and inks in order for ink suppliers to comply with regulations. This new chemistry in printing would require substantial development work for analytical and subjective acceptability as well as machinability.

The Council of Northeastern Governors (CONEG) legislation currently designates acceptable limits for 4 heavy metals. It is expected that the number of metals that will be targeted by this legislation will increase. This requires new formulations of inks which have to be reviewed by purchasing and R&D as well as development of new methods to analyze for the metals.

Due to residual solvents which remain after printing, Purchasing Technical Services in conjunction with Packaging Studies has developed a list of solvents which cannot be used, and threshold limits for others. Further additions to this list based on environmental, toxicological or subjective acceptability would also require suppliers to develop new formulations.

Environmental concerns are requiring paper suppliers to make changes to papermaking processes in order to reduce dioxin levels. This again requires chemical, subjective and machinability testing for approval of new paper products.

Increasing pressure to use higher levels of recycled materials in packaging will require the evaluation of its effect on manufacturing flexibility. Pending federal legislation on

the issue of natural versus man-made components will force further scrutiny of the flavors which are used in our products. Specification of all ingredients poses a proprietary risk for both the flavor suppliers and PM. In addition, toxicological studies may result in removal or substitution of flavor components which are unacceptable. Finally, consolidation of companies in the flavor industry and thus, changing management, could compromise our available resources, especially if new management decisions do not support the tobacco industry.

The largest tobacco seed supplier, Northrup King, recently eliminated their tobacco research and breeding work with tobacco, leaving two minor suppliers, Spiegth and Richard Gwynn Seed Co., that continue research in this area.

#### **R&D Response:**

Develop proprietary products and technology to facilitate and control our position and ensure exclusivity for these products from our suppliers.

Complete the establishment of specifications for incoming materials (flavors, papers, adhesives, packaging materials and packaging inks).

Maximize utilization of suppliers and resources. This may result in reducing the number of suppliers we use for a specific type of material (e.g. adhesives).

Keep abreast of pending legislation and environmental concerns which our suppliers must comply with. Expand existing materials evaluation and specification programs as necessary to monitor changes in raw materials.

Evaluate the feasibility of using vendors who use recycled materials (e.g. packaging).

#### **PRODUCT QUALITY**

##### **Likely Scenario:**

As the market volume continues to grow in the price/value segment, product quality can become an essential differentiating factor. With three price tiers now a reality, quality must be judged against competitive products in the same price range, and our strategy must be to be superior within each tier. Cost cutting measures should be achieved through the use of new technologies and/or processes which do not significantly impact product quality. An example involves our work with offset printing. Offset printing has several advantages, including lower cost and higher quality. In addition, offset printing is good for short runs, thereby providing a flexibility advantage. However, materials

utilized in offset printing impart a negative subjective effect on our products when brought in close proximity. Currently, an investigation is being undertaken on the chemical components.

**R&D Programs:**

- Operations Support
  - Adhesive Specifications
  - Offset Printing
  - Materials Evaluation
- Optical Processing
- Processing Sensing & Control
- New Expanded Tobacco
- Marlboro Standardization

**COST EFFICIENCY**

**Status:**

As indicated in the PM USA Five-Year Plan, cost efficiencies should be maximized throughout the Company. New products, new technologies and the large number of issues facing the Company in the foreseeable future all may threaten to increase the cost of doing business. R&D programs are generally conducted in a manner that maintains PM's proprietary position. While this strategy may increase initial R&D investment, and therefore R&D cost, "ownership" of important product and process technology can certainly lower the overall cost to the Company by allowing us to exercise some control over the vendor as well as allowing us to "spin off" or license such technology if it is in our interest to do so.

**R&D Response:**

Continue to consider cost efficiency a major factor in all R&D endeavors.

Continue to focus on programs which will improve our proprietary positions and thereby provide a more cost-effective means of doing business.

Focus resources on issues which may adversely affect the cost efficiency of the Company (consolidation of product specifications, alternate tow and paper fibers). For example, developing proprietary methods of dealing with environmental issues will improve our ability to do business in a cost-effective manner when faced with environmental restrictions and regulations.

## OBSOLESCENCE OF THE CURRENT PRODUCT

### **Status:**

In order to address consumers' and potential consumers' concerns while dealing with a declining market, radically new products will be essential. Clearly, there has been an extensive amount of activity in this area. In addition to products such as Next, Premier, Chelsea, Horizon, and Superslims, extensive patent activity is evident by the huge volume of patents in smokeless cigarette devices, inhalers, aerosol dispensers, release compositions and transdermal delivery patches. Abstracts of patents issued in these areas from 1/1989-8/30/90 are compiled in Appendix M. If products such as nicotine chewing gum and nicotine patches are used as cigarette substitutes by a significant number of our customers, the loss in sales could not be regained by marketing a conventional product.

### **Likely Scenario:**

Obsolescence of our current product is not likely within the plan period, however, technological breakthroughs and innovative products are highly likely in the next ten years. Our efforts to develop innovative new products should receive high priority.

### **R&D Programs:**

- Project Beta
- Project ART
- Paper Technology/Reduced Sidestream
- Combustion Research
- Aerosol Research
- Chemical Senses

## OBSOLESCENCE OF CURRENT PROCESSES

### **Status:**

Tobacco processing operations have changed very little over the years in which significant changes have been made in production and product requirements.

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**Likely Scenario:**

Environmental issues, new products requiring radically different processes, and the need for manufacturing flexibility will lead to an increase in process development activities.

**R&D Programs/Response:**

The New Expanded Tobacco Program has been established to develop expansion technology and associated processing for the production of expanded tobacco materials having the physical and subjective characteristics required to support future product needs. Immediate goals are to reduce tobacco degradation and to improve processing uniformity of the existing DIET process. These improvements will be incorporated in the design of future DIET process installations.

A program has been initiated for the development of cast leaf. The program will address the following PM USA strategic business requirements: 1) reconstituted sheet capacity through the 1990's; 2) environmental limitations of the current BL process; 3) manufacturing flexibility to meet future product needs; and, 4) support of PM International needs for reconstituted sheet technology.

A process development need has been identified for the development of new primary processing technology to meet future product mix requirements with maximum achievable quality and yield.

**DEPENDENCE OF R&D ON SUPPLIERS****Status:**

Experience has shown that vertical integration of businesses for the manufacture of raw materials/supplies has not performed as expected. This concept impacts negatively on product flexibility and quality. Most of our materials and supplies are purchased and a significant amount of reliance is placed on the suppliers. The selection of suppliers should be based on sound procedures for identifying and qualifying the supply sources.

A significant amount of progress has been made in this area. However, situations could develop which would result in: 1) shortages of raw materials; 2) key suppliers going out of business; and, 3) unfavorable business relations with suppliers.

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### **Likely Scenario:**

As new products and processes become an essential part of our business, new technologies and materials will be required which will increase our need to maximize our utilization of suppliers and their resources.

### **R&D Response:**

Develop proprietary products and technology to facilitate and control our position and ensure exclusivity for these products from our suppliers.

### **R&D Programs/Response:**

Identify and establish close relationships with high quality companies and other sources for providing the expertise and/or materials needed to support R&D programs.

Materials Evaluation  
Flavor Specifications  
Adhesive Specifications  
Monogram Inks

## **SUMMARY OF FUTURE FACTORS**

The future factors affecting the business are many and varied. Factors discussed in this section are summarized below:

### **Marketplace Factors:**

Key marketplace factors that impact future new product development are:

- Dynamic market (new segments)
  - older smokers
  - price/value
- Declining market
  - complete brand families
  - value-added products
  - maximize PM share in underrepresented segments (menthol, ultra low tar, price/value)
- Increasing export markets and volume

- continue growth
- create new segments in international market (Next; Menthol-Japan; ultra low tar-Japan)
- Product changes due to Government Regulations
  - ignition propensity
  - ingredient regulations
  - smoke content regulations/labeling
  - smoking restrictions (low sidestream products, room ventilation technology)
- Technology-Driven Products
  - low tar with enhanced flavor
  - nicotine segmentation
  - sidestream reduction
  - sidestream odor reduction/modification
  - non-traditional smoking articles

#### Social/Political Factors:

Key social/political factors affecting the industry include:

- Perceived health concerns
  - non-traditional smoking articles
  - Surgeon General's Report
  - ETS
  - scientific/toxicological research toward the development of a causal link
- Social Acceptability
  - smoking restrictions
  - designated smoking sections
  - ETS/sidestream smoke
  - social trends
  - strategies of anti-smoking groups
- Legislative Activity
  - quantity
  - variety (taxes, smoking restrictions, advertising restrictions, sampling restrictions, "fire-safe," sale to minors, vending machine legislation, workplace discrimination)
  - factors affecting activity (social trends, anti-smoking group strategies, potential distraction by other national issues).

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- regulation of ingredients
- regulation of smoke content and constituents
- ignition propensity
- Environmental Issues
  - emissions (CO<sub>2</sub> , VOCs)
  - process effluents (phosphates and nitrates)
  - waste disposal (liquid flavors, nicotine disposal, recycling)
  - pesticides/fumigations (Kabat® to replace phosphine)
  - ETS (room ventilation systems, product modifications)
- Product Tampering
  - crisis management team/R&D support
  - use of company synergy on packaging

### Technological Factors

Technological factors that will impact our business include:

- Externally developing technologies
  - large number
  - rate of development
  - R&D technology assessment function
- Strategic technologies
  - identification
  - needs of R&D programs
  - implementation methods

### Internal Environment Factors

A number of internal factors will impact our business during the plan period. These are:

- Technology Management available
  - rate of change in technologies
  - personnel skills (training)
  - availability of skilled workers (science education support)
  - technology transfer/product commercialization

- R&D Resources
  - people/skills
  - facility
- Capacity
  - production capacity limitations
- Manufacturing Support
  - high speed equipment
  - commercialization of new technology-driven products
- Raw Material Supply
  - shortage potential
  - modifications to materials
  - suppliers relations
- Product Quality
  - value-added
  - cost management
  - product integrity
- Obsolescence of Current Product/Processes
  - intellectual property rights
  - new product segments
  - novel smoking articles
  - environmental, quality, capacity, cost and flexibility needs driving new process development
- Dependence on Suppliers
  - develop proprietary position
  - establish productive relations

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R&D Issues

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**G. R&D ISSUES**

From the analysis of future factors, a number of issues have been identified which are expected to have the most impact on R&D during the plan period. These are:

PRODUCT INTEGRITY  
PRICE/VALUE  
HEALTH PERCEPTION  
SOCIAL ACCEPTABILITY  
GOVERNMENT REGULATIONS  
TECHNOLOGY MANAGEMENT

The objective relevant to each issue and pertinent R&D programs are listed below:

**PRODUCT INTEGRITY**

**Objective:**

Address situations which impact all aspects of product quality.

**R&D Programs:**

Operations Support  
Quality Assurance Support  
Tobacco Processing Support  
Production Support  
Miscellaneous Support  
Optical Processing  
New Expanded Tobacco  
Cast Leaf Process  
Project Natural  
Ingredients  
Menthol  
New Packaging Concepts  
Process Development Studies  
Flavors  
Consumer Testing Research

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## VALUE-ADDED PRODUCTS

### **Objective:**

Develop products which are perceived to be of high value (financial, psychological, sensory) by the consumer.

### **R&D Programs:**

- Domestic Product Development
- International Product Support
- Project ART
- Reduced Sidestream/Paper Technology
- Project Ambrosia
- Project Natural
- Low Tar/High Flavor
- Menthol
- Consumer Testing Research

Other long-term programs that provide key product advantages to the consumer.

## HEALTH PERCEPTIONS

### **Objective:**

Develop products which address consumer health perceptions.

### **R&D Programs:**

- Low Tar/High Flavor
- Selective Filtration
- TSNA
- LBA
- Combustion Chemistry and Physics
- Project Beta
- CO Reductions

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## SOCIAL ACCEPTABILITY

### **Objective:**

Develop products that address the social issues facing our products.

### **R&D Programs:**

- Reduced Sidestream/Paper Technology
- Project Ambrosia
- Basic Research (Aerosol Research, Flavor Research)
- Project PACT
- Project Natural
- Project Beta

## GOVERNMENT REGULATIONS

### **Objective:**

Meet or exceed government regulations facing our business.

### **R&D Programs:**

- Project Tomorrow
- Ingredients
- Reduced Tar and Nicotine/International
- Environmental Five-Year Plan

## TECHNOLOGY MANAGEMENT

### **Objective:**

Develop the appropriate resources to provide an environment in which technology-driven products can be developed to grow our business.

### **R&D Actions:**

- Technology Assessment
- Personnel Skills Mix/Change/Availability
- Training
- Utilize External Resources/Suppliers

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Protect Intellectual Property Rights  
Synergy  
Technology Transfer

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## H. R&D STRATEGIC GOALS

R&D's Strategic Goals are based on PM USA's five-year goals, an analysis of the future factors which may significantly impact the attainment of those goals, and the key issues facing R&D. R&D's Strategic Goals for the 1991-1995 Plan period are:

1. **Support** the company's present product lines and business operations.
2. **Grow** the business **short-term** with new/optimized products and processes for both domestic and international markets.
3. **Address** consumer wants and external requirements with new technology-driven products.
4. **Grow** the business **long-term** by identifying, evaluating, developing and implementing new technologies potentially applicable to future products and business needs.

The Strategic Goals and the R&D Programs (current and projected) that support each goal are outlined in Tables 26-29. Current and projected resource allocations are given for each program in each plan year. The rationale for the projected resource allocations for each program is outlined in the next section. A break down of the resources allocated to each program is given in Appendix N, and divisional resource allocations to each program are given in Appendix O.

In certain cases, an R&D program may support more than one Strategic Goal. For example, Project Beta would address consumer wants and external requirements with technology-driven products, as well as grow the business in the long-term by implementing new technologies. Programs that apply to more than one Strategic Goal are indicated in Tables 26-29 by the percentage of the resources applicable to the indicated Strategic Goal shown in parenthesis next to the name of the program. In such cases, the resources devoted to the program were allocated to the given Strategic Goal by the percentage indicated. A discussion of the main components of each Strategic Goal are outlined below.

### **Strategic Goal Number 1 - Support The Company's Present Product Line and Business Operations.**

As can be seen in Table 26, all of the programs that fall into this Strategic Goal, except the Primary Improvement are locally in place. However, the emphasis of certain

programs has changed and/or will change over the plan period. For example, the components of Operations Support for 1990 (Table 5) have been changed (Table 30) to reflect the completion of certain projects (Flavor Specifications and Project Warhol) and the addition of others (Adhesives, Cigarette Monitoring, Monogram Inks, Packaging Inks and Solvents, Engineering Studies, Cooperative Leaf Studies, and Environmental Issues). The major strategies associated with all major R&D Programs are outlined in Appendix Q.

The other major R&D Programs in Strategic Goal Number 1 besides Operations Support include Optical Processing, New Expanded Tobacco, Cast Leaf, and Project ART. The New Expanded Tobacco and Cast Leaf Programs became major programs in 1990 to address various issues relating to the DIET and RCB processes. Some of the issues involved include capacity, quality, flexibility, and environmental concerns. Resources devoted to new expansion process development will decrease after 1993, when a new process must be ready to meet capacity issues. Cast Leaf resources will remain steady throughout the period due to the need to adopt the process to specific needs once it's developed. Optical Processing will continue to deal with the development and implementation of product inspection systems. These systems include a pack inspection system which will be ready for factory trial in first quarter, 1991; an off-line print inspection system which will be redesigned and delivered to QA and Colonial Heights Printing by early 1992; and an on-line web inspection system which will be delivered to Colonial Heights Printing in late 1991. Resource allocations are expected to be maintained throughout the plan period as the development of other inspection systems (i.e. cigarette) is initiated. Finally, resources devoted to the ART program will decrease dramatically (75%) over the plan period. Resources will be devoted mainly to process support and the development of the reduced nicotine segment products.

The Primary Improvement program will involve the characterization of existing primary processes to establish the baseline thermal history, chemical changes and flavor reactions. In addition, factors such as low operating cost, highly flexible operation, equivalent or improved product quality/subjectives, and environmental issues will be considered when simplifying the process. Process Plant Support involves general support to processing/recon plants and will most likely become part of the Operations Support Program in 1991 due to the continuing nature of these support activities. Computing systems, Measurement and Sensing of Physical and Chemical Characters (Process control systems) and Consumer Testing (33%) will function in a supportive role through the plan period. Expert systems, artificial intelligence, optical inspection software, process monitoring and control (i.e. Kabat® application), and various consumer monitoring programs constitute some of the components of these programs.

**Table 26**  
**Strategic Goal Number 1**

**Support the Company's Present Product Lines and Business Operations**

Program	Resource Allocations					
	Year					
	1990	1991	1992	1993	1994	1995
Operations Support	95.6	87.5	96.3	104.8	109.8	115.5
Optical Processing	8.0	8.4	8.6	8.4	9.8	9.7
New Expanded Tobacco	32.1	49.0	37.4	26.8	18.3	16.3
Cast Leaf Program	13.0	18.3	28.1	26.1	22.0	20.9
Project ART	67.5	48.9	34.7	29.1	24.9	16.9
Consumer Testing (33%)	0.4	0.4	0.4	0.4	0.4	0.4
Meas. and Sensing of Physical and Chemical Char.	3.5	1.3	1.3	1.3	1.3	1.3
Computing Systems (50%)	1.9	1.3	1.3	1.4	1.4	1.4
Process Plant Support	2.6	7.0	5.8	7.7	9.7	9.8
Primary Improvement	0.0	5.3	4.0	2.7	3.1	4.0
TOTALS	224.6	227.4	217.9	208.7	200.7	196.2
	199.4					
	114.5					
	73.3					
	<u>610.0</u>					

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**Table 27**  
**Strategic Goal Number 2**

**Grow the Business Short-Term With New Optimized Products and Processes**  
**for Both Domestic and International Markets**

Program	Resource Allocations					
	Year					
	1990	1991	1992	1993	1994	1995
Reduced SS/Paper Technology (33%)	16.9	16.3	16.0	16.7	15.9	14.9
Low Tar/High Flavor (50%)	6.5	7.0	6.1	6.8	6.6	6.6
Filtration Research	11.7	9.4	11.6	11.8	11.8	11.7
Domestic Product Development	81.3	81.2	84.1	90.2	90.2	94.6
International Product Support*	64.7	64.6	67.5	70.5	72.2	74.4
Menthol	8.3	7.8	8.1	7.4	7.0	7.6
Project Ambrosia/Ashtray Odor (50%)	5.1	5.5	5.7	5.0	3.0	1.4
New Packaging Concepts	0.3	0.3	0.3	0.3	0.3	0.3
Flavors (50%)	4.2	3.8	4.1	4.1	4.4	4.8
Consumer Testing Research 33%	0.4	0.4	0.4	0.4	0.4	0.4
<b>TOTAL</b>	<b>199.4</b>	<b>196.3</b>	<b>203.9</b>	<b>213.2</b>	<b>211.8</b>	<b>216.7</b>

\*Includes 41 QZ personnel

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**Table 28**  
**Strategic Goal Number 3**

**Address Consumer Wants and External Requirements With  
New Technology-Driven Products**

Program	Resource Allocations					
	Year					
	1990	1991	1992	1993	1994	1995
Project Tomorrow	10.6	20.5	23.7	26.1	29.1	21.1
Project Sigma/Beta (50%)	24.8	19.7	22.7	24.6	25.2	21.9
TSNA	26.6	24.6	24.4	18.4	16.0	16.7
LBA	19.9	14.9	13.0	13.1	17.1	17.1
Reduced SS/Paper Technology (33%)	16.9	16.3	16.0	16.7	15.9	14.9
Project Ambrosia/ Ashtray Odor (50%)	5.1	5.5	5.7	5.0	3.0	1.4
Project PACT	3.9	3.6	0.8	0.5	0.3	0.0
Project Natural	2.1	2.0	1.7	0.9	0.9	0.9
Ingredients	2.8	3.7	3.8	4.1	4.1	4.1
Reduced Tar and Nicotine Intl.	2.4	2.3	2.2	2.2	2.2	2.1
Aerosols (50%)	3.4	3.7	3.7	3.7	3.7	4.4
TOTALS	118.5	116.8	117.7	115.3	117.5	104.6

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**Table 29**  
**Strategic Goal Number 4**

**Grow the Business Long-Term by Identifying, Evaluating, Developing, and Implementing  
New Technologies Potentially Applicable to Future Products and Business Needs**

Program	Resource Allocations					
	Year					
	1990	1991	1992	1993	1994	1995
Project Sigma/Beta (50%)	24.8	19.7	22.7	24.6	25.2	21.9
Reduced SS/Paper Technology (33%)	16.9	16.3	16.0	16.7	15.9	14.9
Low Tar/High Flavor (50%)	6.5	7.0	6.1	6.8	6.6	6.6
Selective Filtration	1.9	3.2	5.6	6.4	6.3	9.0
Combustion Research	0.8	1.5	4.1	4.2	4.1	2.9
Flavors (50%)	4.2	3.8	4.1	4.1	4.4	4.8
Aerosols (50%)	3.4	3.7	3.7	3.7	3.7	4.4
Selective Separations	3.4	3.8	4.7	6.6	12.6	21.9
Consumer Testing Research (33%)	0.4	0.4	0.4	0.4	0.4	0.4
Chemical Senses	2.6	3.0	5.9	9.2	12.3	13.6
Biological	4.4	7.0	8.1	8.2	8.8	9.5
Computing Systems (50%)	1.9	1.3	1.3	1.4	1.4	1.4
Basic Analytical Research	2.1	2.6	2.6	2.7	3.3	4.0
Plant Tissue Culture	0.0	1.8	2.6	2.7	2.7	2.7
Biochemical Processing	0.0	0.0	0.0	1.3	2.7	2.7
Project Alpha	0.0	0.0	0.0	0.0	0.0	6.7
TOTALS	73.3	75.1	87.9	99.0	110.4	127.4

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**Table 30**

**Operations Support Projects**

Adhesives  
Cigarette Monitoring  
Materials Evaluation  
Customer Complaints  
Flavor Development Analytical Support  
Marlboro Standardization  
Alternate Humectants/Preservatives  
Microbiological Quality Improvement  
Monogram Inks  
Packaging Inks and Solvents  
Semiworks Support  
Burley Spray/Dry Flavors  
ETS Studies  
Entomological Support  
Engineering Studies/Method  
Recon Sheet Certification  
Cooperative Leaf Studies  
Environmental Issues

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## **Strategic Goal Number 2 - Grow the Business Short-Term with New/Optimized Products and Processes for Both Domestic and International Markets.**

Programs directed toward this Strategic Goal are listed in Table 27. Domestic Product Development and International Product Support (includes 41QZ personnel) are the key components of this Goal. A steady increase in resources is projected for the plan period in order to deal with an increasing number of new products. Because of the variety and complexity of some of the issues facing product development endeavors (ingredients, component consolidation, brand extensions, novel products, government regulations), additional resources are clearly needed.

The other programs listed in this Strategic Goal, some of which are major programs, largely support these new product endeavors. The Paper Technology/Reduced Sidestream Program and Project Ambrosia deal with sidestream acceptability issues, while the Low Tar/High Flavor program's objective is to increase the "value" of low tar products to the consumer. Older smokers would likely take advantage of a product with subjective advantages in this segment. Filtration Research and Flavors are aimed at providing a selection of alternatives for new product development that would maximize achievement of the program's goal. For example, the paper core concentric filter, developed in the Filtration Research program, is a key component of the Low Tar/High Flavor BOLD product. Consumer testing indicates that this filter enhances the "strength" and "impact" of the smoke in low tar cigarettes. Potential utilization of this filter in other products is being investigated. In addition, the New Packaging Concepts program contributes to new product development activities with package design alternatives.

Ultimately, the Menthol program is aimed at increasing PM representation in this market segment. Therefore, a successful entry product against solid brands like Newport and Kool would not be likely. Therefore, the Menthol program is aimed at developing a product with distinct advantages over Newport and Kool. Methods to stabilize menthol in the cigarette and increased "freshness" are being investigated.

Finally, consumer testing research is essential to successful product introduction. Consumer wants, perceptions, and subjective quality are necessary information for new intelligent new product development and commercialization. The quality of this test information is the key point of this program.



### **Strategic Goal Number 3 - Address Consumer Wants and External Requirements With New Technology-Driven Products.**

This strategic goal focuses on the needs of the consumer as they relate to external requirements. Government regulations and social acceptability issues are key driving forces for these programs. The program and resource allocations are listed in Table 28. Objectives and strategies for the major programs Project Tomorrow, Project Beta, TSNA, LBA, and Paper Technology/Reduced Sidestream are found in Appendix Q. Most of these programs are at least partly long-term in nature, and in most cases resource allocations remain steady. Although difficult to predict, efforts in ignition propensity (Project Tomorrow) and Lowered Biological Activity are likely to increase during some point in the plan period. Passage of the Fire-Safe Act of 1990 indicates that considerable product development work will be necessary after the completion of the work mandated by the Act. Significant resources are being devoted in the scientific community to develop direct experimental evidence relating cigarette smoke to lung tumor formation. Additional PM resources will most likely be needed to address any potential issues arising from this work. Resources in the LBA program would have been predicted to increase far more than indicated if R&D did not have access to other resources (INBIFO) skilled in this area. The Reduced Sidestream/Paper Technology Program is important to both the reduced sidestream issue and the ignition propensity issue. While certain products under development in Project Ambrosia are short-term in nature, additional flavors and flavor release compounds generated by Chemical Research personnel provide a longer-term component to this program.

Other programs in Strategic Goal Number 2 include Project PACT, which will conclude during the plan period. R&D efforts in this area will focus on the implementation of the already developed technology and the development of a university-based facility to design, develop and test air handling/ventilation action systems. Project Natural involves the development of an acceptable product with a minimal number of non-tobacco ingredients. The driving force for this work relates to the negative consumer perception of artificial components in consumable materials.

The Ingredients Program and the Reduced Tar and Nicotine Program both relate directly to government regulations, and efforts are expected to be maintained in these areas throughout the plan period. Aerosol research (50%) is included in this Strategic Goal because of its strategic importance to Project Beta, and the obvious strategic importance of Project Beta in addressing the external requirements facing the company.

#### **Strategic Goal Number 4 - Grow the Business Long-Term by Identifying, Evaluating, Developing and Implementing New Technologies Applicable to Future Products and Business Needs.**

In the next five to ten years, our marketplace and product will be, in all probability, dramatically different from what we know today. Perceived health concerns, ignition propensity, social acceptability, environmental concerns and governmental regulations are likely to change our business significantly in the next five- to ten-year period. Therefore, resources (Table 29) devoted to longer-term projects are expected to increase significantly over the plan period. These increases are largely due to the identification, evaluation, and implementation of strategic technologies over the plan period. Selective Filtration, Selective Separations, Biochemical Processing, and the Chemical Senses are key components of this increase.

Project Beta (for Operational Plan, see Appendix A) is a key and steady component of the efforts devoted to this Goal. A Beta product would address most issues facing our products. Project Alpha, scheduled to be initiated once Beta is nearing completion, involves an extension of Beta to a novel configuration that does not necessarily relate to a cigarette. The optimization of the delivery device without regard to a cigarette-like configuration is the objective of this proposed area.

The Paper Technology and Low Tar/High Flavor programs both have long-term components. Paper is an essential controlling element of our products, and novel papers will be developed and tested to meet varied product needs. Chemical Senses is an essential program for our future. Chemical Senses research encompasses the development of a fundamental understanding of those physical, chemical and biological system interactions that result in a favorable response to the product. Through basic knowledge and evaluation of the taste and olfactory effects of our products, essential key product components can be maximized. The Flavor and Aerosol research programs also tie into future product development and studies on the chemical senses.

The Selective Separations and Selective Filtration programs are largely defensive. New Separations technology may be required in the future to address product component and/or environmental issues. The Biological and Biochemical Processing programs would also provide separation/destruction techniques through the use of antibodies, biosensors, and/or enzymes. Basic Analytical Research, Consumer Testing Research and Computing Systems would support long-term product development by providing the necessary tools by which to measure our future new products.

As part of the technology review process, the basic research areas that impact our major programs were identified. The basic research programs identified in this Strategic Goal

also impact many other aspects of the R&D work product. The interdependent nature of these programs is depicted in Table 31.

Table 31  
Basic Research Support To R&D Major Programs

R&D PROGRAM AREAS	← BASIC RESEARCH AREAS →								
	Aerosols	Biological	Catalysts	Combustion Research	Computing	Consumer Testing	Flavors	Measurement /Sensing	Separations
Ambrosia						✓	✓		
ART		✓			✓	✓	✓		✓
Cast Sheet		✓		✓			✓		
Domestic Product Support						✓			
International Product Support						✓			
Expanded Product		✓		✓	✓		✓		
Filtration Research	✓		✓		✓	✓	✓		
LBA		✓		✓					✓
Low Tar/High Taste	✓	✓		✓		✓	✓		✓
Operations Support					✓			✓	
Optical Processing					✓			✓	
Paper Technology/ Reduced Sidestream	✓			✓			✓	✓	
Pact	✓		✓				✓		✓
Tomorrow			✓	✓	✓	✓		✓	
TSNA		✓		✓					✓

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Implementation

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## **APPENDICES**

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## I. IMPLEMENTATION

### R&D Major Programs

The R&D Major Programs, their objectives and major strategies are outlined in Appendix Q. Operational Plans are developed for each program by the program coordinator and reviewed on a quarterly basis at the R&D Quarterly Planning meeting. Operational Plans for these programs covering the plan period have been drafted and will be reviewed at the December 1990 R&D Planning meeting. Final copies of Operational Plans will be appended, in a separate notebook, to this plan in early 1991.

### Program Areas Currently Under Development

Several of the R&D programs listed, that are not major programs at this time, have the potential of becoming major programs during the plan period. These are key areas in which R&D is expected to build resources:

1. Primary Improvement Program
2. Environmental Issues
3. Combustion Research
4. Chemical Senses

The Primary Improvement Program would cover studies on the evaluation and simplification of primary processing in order to provide a low cost, highly flexible primary operation that improves product quality and processing emissions. Environmental issues will clearly impact our business operations during the plan period, and R&D's role involves technical support and process development improvement efforts. Combustion Research, or the chemistry and physics of combustion, involves the development of a knowledge based on the components of smoke, their tobacco precursors and methods of controlling their formation. The Chemical Senses program encompasses the development of a fundamental understanding of the physical, chemical and biological interactions that result in a favorable subjective response. The need for more control with traditional products (i.e. Low Tar/High Flavor) and the need to reproduce cigarette smoke subjectives in novel products (i.e. Project Beta) are the driving forces for these developing areas.

### R&D Resources

Table 32 shows the projected resource allocations for PM USA R&D through 1995. Specific resource allocations by Program and Division are detailed in Appendices N and O, respectively. As outlined in this plan, the number of issues facing the Company are

Table 32

**Projected R&D Personnel Requirements<sup>1</sup>  
1990-1995**

	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>
Directly Allocated	415.8	434.8	445.4	446.3	450.3	454.3
Support	118.2	99.2	100.6	108.7	108.7	108.7
Total	534.0	534.0	546.0	555.0	559.0	563.0
Exec. and Admin.	43.0	43.0	43.0	43.0	43.0	43.0
Total	577.0	577.0	589.0	598.0	602.0	606.0
Increase Over Previous Year	--	0	+12	+9	+4	+4
Cumulative Increase Over 1990 Budget	--	0	+12	+21	+25	+29
Projected R&D Expense Budget (Millions)	93.1	94.4	100.4	102.8	105.9	109.1

<sup>1</sup> Does not include 41 QZ personnel.

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likely to increase over the plan period. The current R&D issues (Product Integrity, Value-Added, Health Perception, Social Acceptability, Government Regulations and Technology Management) will necessitate an increased effort on behalf of R&D. As indicated, a total increase in head count is projected for the plan period.

#### Financial Aspects

The projected R&D expense budget over the plan period is shown in Table 33. Figures are based on the head count increase (including salaries and benefits) and the consumer price index projections (4.2% in 1992, 5.5% in 1993, 5.1% in 1994, and 5.0% in 1995). Since the budget is based upon the total number of people, it increases proportionally to the added head count over the plan period. A comparison of the proportion of manpower allocations in 1991 to the percent of 1991 original budget devoted to each strategic goal is shown in Table 33. Interestingly, this exercise indicates that a considerable amount of resources outside of R&D are contracted to address key issues facing the Company.

#### Facility

The facility plan status is outlined in Appendix P.

#### Action Plans/Recommendations

Appendix P includes some proposed actions toward a key internal R&D issue--Technology Management. Technology Management encompasses a number of dimensions which were outlined in Table 8. Currently, R&D has a technology assessment function. The action plan extends the charter and participants of this group in order to provide a mechanism for the identification and development of strategic technologies. Personnel skills, the proper mix, dynamic needs, future availability issues, support of science education, recruiting, and training are also discussed in the Appendix P sections. R&D has mechanisms in place to deal with the utilization of internal resources, suppliers, and synergy. Many positive outcomes can be cited that resulted from these relationships. The protection of intellectual property rights is supported by an R&D Patent Committee and the Corporate Patent Consul and staff.

Finally, technology transfers and the commercialization of non-traditional products are key issues in Technology Management. Effective interdepartmental communications are essential to the successful implementation of new technologies. Many mechanisms are in place which enhance interdepartmental communication. These include: cross-functional training (Research to Development), organizational changes/lateral transfers both within and outside the department, quarterly planning meetings, the involvement of

**Table 33**

**Comparison of 1991 Head Count and Financial Allocations to Each Strategic Goal**

	1991 Percent of Total <u>Head Count</u>	Percent of Total <u>Budget</u>
Strategic Goal #1 Support	37%	31%
Strategic Goal #2 Grow - Short	32%	21%
Strategic Goal #3 Address	19%	37%
Strategic Goal #4 Grow - Long	12%	11%

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other Operations Departments in R&D quarterly planning meetings and Strategic Planning, and the allocation of personnel from other departments in major programs at an early stage in the program.

Communication between R&D and marketing is also essential to the effective commercialization of new products. A format now exists for this communication. The New Product Introduction Plan covers the short-term requirements of pending test markets and national introductions, as well as longer-term programs which are of market interest.

In summary, a discussion of several areas recommended for further action (several Technology Management issues and the Facility plan) is found in Appendix P. Other dimensions of the Technology Management issues are being dealt with using existing mechanisms. Vigilance to this issue must be maintained throughout the plan period.

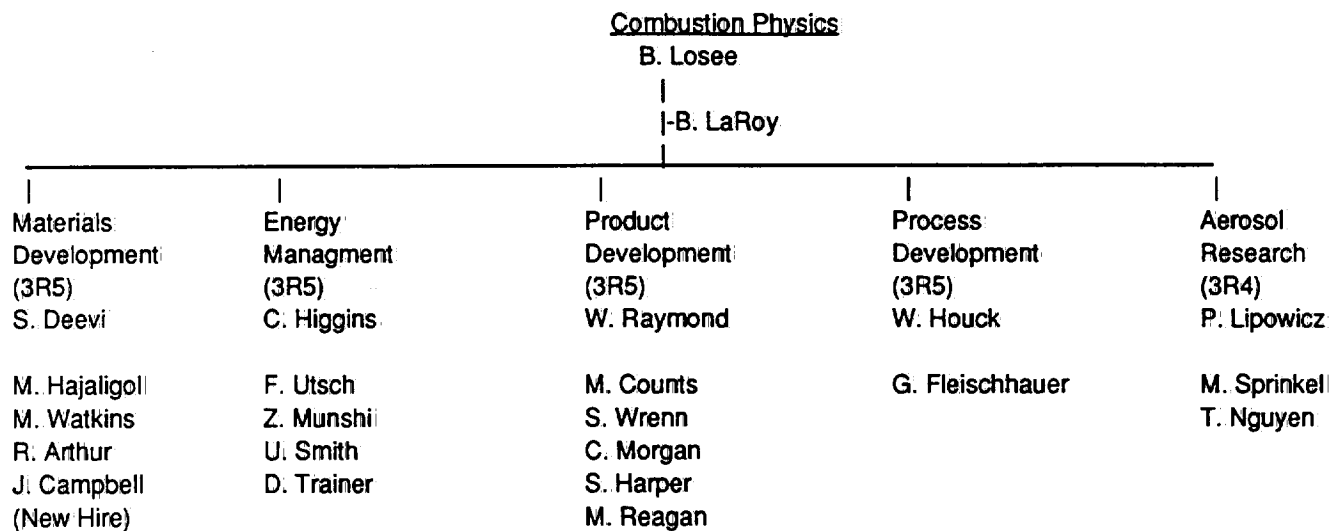
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## **APPENDIX A**

### **Beta Plan**

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## Project Beta R & D Organizational Structure



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## Operational Plan

### Project Beta

#### Status:

Project Organizational Structure in place (see attached).  
Phase I RTX Modules under evaluation.  
Prime Contractor identified; development contract awaiting signatures.  
Heater Design Team in place: concurrent approach to define manufacturable, low cost cartridge with R&D, Engineering and MDF personnel.

#### Plans:

Define RTX Prototype Performance - (2nd Quarter, 1991):

Electrical;  
Delivery;  
Subjectives:

Smoke Perception;  
Packaging.

Define Power Supply needs for Phase III device  
(Dependent on Prime Contractor Involvement).

Define Manufacturable Disposable Cartridge - (2nd Quarter, 1991).

Define Application Methods:

Tobacco - (1st Quarter, 1992);  
Ohmic contacts - (3rd Quarter, 1991).

Specify manufacturing process for Disposable Cartridge - (1st Quarter, 1992).

Delivery Phase III Modules - (3rd Quarter, 1992)  
(Dependent on Prime Contractor Involvement).

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Appendix B

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## **APPENDIX B**

### **PM Europe R&D Plan**

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## RESEARCH AND DEVELOPMENT PLAN 1991-1993

### EXECUTIVE SUMMARY

The four scientific and technical departments of R&D with the assistance of the three support groups will concentrate their efforts on product and environmental issues during the planned period.

The R&D strategic goals include providing the support to maintain our market leadership through the development of innovative products, the maintenance of our product lines and providing for the Company the technology base necessary to address pressures from external sources. Emphasis will be given to product modification and monitoring to ensure compliance with emerging product legislations.

In addition to improving and developing new products which meet marketing requirements, Product Development will focus its attention on the medium and long term planning of the design of our product lines to ensure compliance with the future EEC tar ceilings. Moreover, emphasis will be given to the development of low delivery products using novel filters possessing specific characteristics and yielding product advantages.

Quality Assurance will concentrate on programs which will result in product quality improvements such as supplier rating, training of QA personnel in affiliates and licensees and improved supervision of sanitary conditions of our leaf purchases. During this 3 year cycle, an improved and standardized European system for the evaluation of consumer complaints will also be developed and used as a quality management tool. Standardization of the Marlboro flavor system with the USA will be pursued, resulting in significant cost savings.

In order to better support Product Development and to improve product monitoring to ensure compliance with future EEC tar ceiling limits, a significant increase in CI analyses will be made available during the planned period.

The Process Development Department will continue its ongoing efforts in order to standardize and improve affiliates' and licensees' primary processes which will significantly improve the quality and yield of the cut filler. Substantial support will be given to help the different factories to achieve their capacity increase plans.

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Besides its ongoing role of supporting Product Development and developing state-of-the-art analytical tools, the Research department will concentrate its efforts in contributing to the establishment of an efficient administration system (Data Management System) aimed at monitoring tobacco product legislation in all EEC/EEA markets. Emphasis will be given to product legislations and environmental regulations which may influence manufacturing practices. A plan, based on the German example, for monitoring compliance of all our products and factories to future legislation will be developed during the planned period.

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# THREE-YEAR PLAN 1991-1993

## PRODUCT DEVELOPMENT

### PRESENT POSITION

#### 1. SUPPORT THE CURRENT BUSINESS

##### MARLBORO

- Within the framework of the Marlboro Monitoring Program in the major EEC and EEMA markets, cigarettes for blind product tests have been made in order to monitor consumer perceived product performance.
- A blend optimization program has been conducted on the PE Marlboro. Product candidates have been tested in France, the Netherlands, Belgium, Germany and Switzerland. The market test results will be available in the fall of 1990.
- A tailor-made blend for menthol products was successfully developed which resulted in a new Marlboro Light Menthol (Tar: 9,0 mg, SN 0.7 mg) launched in France in July 1990.
- A program has been initiated in view of changing the size of Marlboro FF and Light from LS to KS in Finland. The implementation is foreseen to take place during the summer of 1991.

In order to be in line with the Tobacco Pesticide regulations in Germany, a blend optimization program has been achieved and implemented on Marlboro Lights in Germany.

- A blend and flavor combined with the cigarette construction optimization program has been started on licensees' products for Hungary, Yugoslavia, Poland, with the aim of bringing these products closer to the PE Marlboro.

##### PHILIP MORRIS

- A Philip Morris Ultra 100's (Tar 2.0 mg, SN 0.2 mg) was launched on the Swiss market in May 1990 as line extension of the Philip Morris Ultra KS.
- The development of two slim products, the Philip Morris Lights as well as the Philip Morris Multifilter Ultra Lights was completed and both products have been simultaneously introduced on the Italian market in January 1990.
- A Philip Morris Lights KS (Tar class 1, total weight below 850 mg) has been developed and launched in Sweden end of February 1990. In the same frame, the development of a Philip Morris Superlights within the same tar range is

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ongoing. Market introduction to take place in spring 1991 in Sweden.

- In order to be in line with the Tobacco Pesticide regulations in Germany, a blend optimization program has been successfully realized and implemented for the Germany Philip Morris Lights and Philip Morris Ultra Lights KS.

#### MERIT

As a line extension of the Merit (Tar 8.0 mg, SN 0.6 mg) a Merit Ultra Lights KS (Tar 4.0 mg, SN 0.4 mg) was launched in Switzerland in April 1990.

#### MURATTI

- In 1989, a Muratti family improvement program was implemented which involved blend/flavor as well as cigarette construction. The first development step of the program has been achieved on the Muratti Ambassador KS for Switzerland. It will be market tested in November 1990.
- A new Muratti Mild KS (Tar 4.0 mg, SN 0.4 mg) has been conceived and developed using concentric filter technology. The selected candidate is presently being market tested in Switzerland. The launch of that new product is planned for spring 1991.
- A new Muratti Ultra Light KS (Tar 1.0 mg, SN 0.1 mg) is planned to be launched in Switzerland at the same time as the above mentioned product. The development phase will be completed in October 1990.

#### L&M

- A new L&M Lights KS delivering Tar 6.0 mg, SN 0.4 mg has been introduced in the German market in May 1990.
- A new L&M FF KS (Tar 16.0 mg, 1.1 mg) & L&M Lights (Tar 11.0 mg, SN 0.8 mg) was developed and produced for the Norwegian market. It was launched in early September 1990.
- Blended flavor combined with cigarette construction optimization program was initiated in Eastern Europe countries licensees' products.
- In order to reduce product cost a blend construction optimization program is currently in progress on the L&M FF KS sold in Belgium.

#### CHESTERFIELD

- For standardization purposes within the Chesterfield family a change of blend was effected in January 1990 on the Chesterfield FF KS sold in Germany.
- In June 1990 a new Chesterfield KS FF was launched in Finland delivering Tar 14.0 mg SN 1.0 mg.

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- A Chesterfield KS FF (Tar 14.0 mg, SN 1.0 mg) and a new Chesterfield Lights KS (Tar 8.0 mg, SN 0.6 mg) have been manufactured. The Lights was market tested. Launch of both products is planned for autumn 1990 in Switzerland.

#### BRUNETTE

- A blend standardization on all Brunette family products has been successfully achieved in May 1990 and implemented on the Swiss market.

#### BELMONT

- A new Belmont 2002 Menthol (DPM 5.0 mg, SN 0.4 mg) for Finland was developed and produced for launch in early October 1990.

A program was started with the objective of changing the size of the Belmont family products in Finland from LS to KS. Implementation is expected to take place in summer 1991.

#### BOND

A new Bond Ultra Menthol (Tar 1.0 mg, SN 1.0 mg) was made. The product will be launched in Sweden in February 1991.

#### CONGRESS

- A blend optimization program on Congress FF KS and on Congress Lights KS for Saudi Arabia has been completed in early 1990. Implementation took place in July 1990. In view of a similar blend standardization, a change of blend is foreseen for late fall 1990 on Visa FF KS and Visa Lights KS in Saudi Arabia.

#### PARLIAMENT

- A new Parliament 100's Lights (Tar 10.0, SN 0.8) with charcoal recess filter was developed for the German market. This product was introduced in March 1990.

#### CIGARILLO TYPE PRODUCT

In the fall of 1989, a project was initiated with the objective of making a cigarillo-type cigarette for the German market, having physical and taste characteristics similar to an American blended product but using double wrapped reconstituted tobacco sheet. The development phase being already well advanced, the first industrial trials are planned to take place in November 1990 in Germany.

#### LOW COST PRODUCTS

In order to be positioned on the German market in the generic cigarette segment, a development of low SVC products was initiated. A selected candidate is presently market tested against the two major competitive brands (Magnum, Boston).

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## GDR BRANDS' LINE EXTENSION

In view of the coming new market, development has started with line extensions of existing local brands such as F6, Karo and Jewel, having in mind as a first step to modernize the products while keeping similar taste characteristics.

## CONSUMER RESEARCH

In a combined effort with Marketing Research France, a new questionnaire, to be used in Product Test Research, has been developed and successfully tested.

The results were presented to PMI Marketing Research Management in July 1990.

A study, using the French market as a model, was initiated and conducted with the objective to correlate market dynamics, measurable product parameters and subjective attributes based on sensory evaluation. The outcome of this study will provide a better and more accurate understanding on consumer perceived product performance.

## 2. NEW INNOVATIVE PRODUCTS

### LENA (Concept PAPIROSSI)

- The directive of this project is the development of a papirossi-like cigarette with a low tar delivery.

A prototype (9.3 mg tar) was made by using a 50 mm recess and laser perforation

### MOSELLE (Concept Recess)

- The development of a 25 mm recessed cigarette is achieved. A prototype (10.7 mg tar) was developed with the tobacco-high-density concept.

## 3. TECHNOLOGY MANAGEMENT

### BASIC TECHNOLOGIES

The existing cigarette model was improved by introducing a more accurate filtration equation. Furthermore, its possibilities were extended, allowing the prediction of the puff-per-puff smoke yields for standard filter constructions, and the selection of the porous materials in order to obtain the desired ventilation level.

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4. EMERGING TECHNOLOGIES

- A new triple tube-in-tow filter, which significantly flattens the puff-by-puff profile has been successfully developed in order to improve smoke variations.
- The feasibility and reproducibility of the total blend expansion technology using blends treated before expansion has been demonstrated.

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## THREE-YEAR PLAN 1991-1993

### PRODUCT DEVELOPMENT

#### I. SUPPORT THE CURRENT BUSINESS

##### OBJECTIVE

Improve existing products and develop new products which meet the approved Marketing requirements while meeting standardization and productivity objectives.

##### STRATEGIES

- Support actively all programs aimed at monitoring consumer perceived product performance of our key brand families and initiate, when needed, product organization programs in order to ensure our competitive advantage in the market place.
- Improve and maintain our computerized project management system in order to optimize the speed and flexibility of the product development process and the allocation of the internal and external resources needed.
- Provide assistance and support to Manufacturing in order to ensure that product specifications are met during the initial production of newly developed cigarettes, and ensure that cigarette construction know-how is effectively transferred to the manufacturing centers.
- Develop and implement a program in order to reduce tar deliveries of all our brands (if needed) to ensure compliance with the 1993 EEC tar ceiling regulations.
- Develop a long-term plan with the objective to further reduce the tar deliveries of our brands to be in compliance with the 1997 EEC tar ceiling regulations. This plan will have to include future tar delivery segmentation (Light and Ultra Light) as well as an inventory of available emerging technologies which will allow tar reduction while maintaining taste quality at an optimum level.
- Ensure product standardization within brand families, and clear differentiation of product performance between brand families based on business objectives.

##### OBJECTIVE

Strengthen our understanding of consumer perceived product performance.

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### STRATEGIES

- Monitor the evolution of the key competitive products by making optimum use of our current cigarette information activities and ensure quick awareness on competitors' new product introductions.
- Improve and maintain our internal descriptive panel in order to build a consistent data base on subjective product attributes of competitive products as well as cigarette prototypes.
- Improve and maintain, in collaboration with Marketing Research, the computerized model in which market dynamics are correlated with measurable and subjective product attributes in order to strengthen our understanding of consumer perceived product performance.
- Advise Marketing Research on qualitative and quantitative design and content of consumer test questionnaires in order to improve our understanding and the interpretation of consumer test results.

## 2. DEVELOPMENT OF NEW AND INNOVATIVE PRODUCTS WITH LONG TERM EARNING POTENTIAL.

### OBJECTIVE

Create new and innovative product ideas/concepts for the cigarette market.

### STRATEGIES

- Further enhance the interfacing of Product Development and Marketing in the creative thinking process.
- Keep an inventory of all new and innovative product ideas generated within the company.
- Develop and apply a screening system that can be used to select the most attractive opportunities.

### OBJECTIVE

Increase the effectiveness in Technology Management in order to improve product and process innovation.

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## STRATEGIES

- Increase awareness of Technology worldwide and maintain our Technology "storehouse" up to date.
- Strengthen our know-how on the Technology-Product relationships in order to:
  - a) Improve our mathematical prediction models with the ultimate objective of being capable to predict the mainstream and sidestream smoke deliveries on a per puff basis whenever a cigarette component is changed and conversely whereby the system selects components required to achieve product objectives.
  - b) Select and assess key technologies needed for the development of new and innovative products.
- Develop specifically the following selected technologies to the stage of industrial application:
  - Total Blend Expansion
  - Tube-in-tow Filter
  - Concentric Filter
  - Tobacco Sheet Filter
  - CA-web Filter
  - Tobacco Sheet Cigarette Wrapper
  - Dual Cigarette Wrapper
  - Tobacco Extract Flavors
  - Concentric Tobacco Rod

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QUALITY ASSURANCE AND TECHNICAL SERVICES

PRESENT POSITION

1. STANDARDIZATION

- . Specifications for tobacco strips have been established and introduced for all offshore markets. The specifications include audit targets (values to be found during our TQA audit) and production targets (values to be found in the stemmery, before packing).
- . A standard procedure for the air separation efficiency of the stem tester, in line with the forthcoming Coresta method, has been elaborated. Its introduction at our suppliers level has started.
- . The introduction of the new PM infestation-control program in the Licensee factories and warehouses has started. The program is based on prevention, and consists mainly of thorough cleaning and infestation detection with pheromone trapping.
- . A standard method for the recovery and analysis of cut filler from cigarettes has been established. An instrument for the recovery of tobacco from cigarettes has been developed by PM-Berlin. This instrument, produced by an outside company, was introduced in all PME Affiliates.
- . A standard operating procedure for tobacco fumigation has been established. The procedure is in line with PM-USA recommendation. It awaits approval by PM management prior to being introduced.

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- . Specifications for main casing ingredients have been established and submitted to our suppliers. The specifications will be reviewed as soon as the US-specifications are available.
- . Menthol solutions used for foil-mentholation have been standardized. Two solutions have been eliminated, reducing the number of different menthol solutions from four to two.
- . A quality rating of our various suppliers has been established, based on a standardized reporting of defective/nonconform deliveries made to PM-Europe. This quality rating will impact next year's purchasing plan.
- . The task force of smoke-lab supervisors has made considerable progress towards standardization of methods used. Main topics completed include the method for GC analysis of water and nicotine in smoke condensate, organization of smoking analyses and the method defining the acceptability of a smoking run.
- . A task force including all DDD-panel leaders as well as leaf experts has been set up. Its main objectives are the revision of the PME DDD-method, standardization of training given to panel members and improvement of the consistency of results obtained by the different panels.
- . A task force including all Primary-QA supervisors has also been set up, with the objective of standardizing methods and specifications used in the European Primaries.

## 2. CORESTA / ISO

- . Considerable efforts have been dedicated to the CORESTA "harmonization" project. A new method is being established which will ensure the equivalence of smoking results from various types of smoking machines.
- . A new gas chromatography column, recommended to Coresta by PM for the analysis of smoke nicotine, should be qualified by end 1990.

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- . ISO specifications for the new monitor cigarette IM-13 are being established through cooperative efforts between PME and PM-USA smoking laboratories.

### 3. VISUAL INSPECTION

- . The new Philip Morris Packaging Standards have been completed and distributed to the Affiliates. The standards for cigarettes, prepared in cooperation with PM-USA, were finalized and will be available early 1991. Introduction of the new system in PME will start at the beginning of 1991.
- . Comparative studies between old and new visual inspection methods have been completed and showed that similar results are obtained using adequate weighting factors.

### 4. MATERIAL QUALIFICATION

- . Three major projects for material qualifications have been completed. They include the qualification of Courtaulds Tow 3.0/35'000 Y for Pan-European Marlboro KS, new base papers for tipping papers which improve filter-tip-attachments and upgrading/standardizing medium- and high-porous plug wraps.
- . The elimination of Carbowax from all white and black semi-filters is well in progress. Panel results have been positive and supportive.
- . A project has been launched in order to introduce "concentrated base flavors" in European productions.

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## 5. FILTERS

- . A reduction of filter tow-weight has been achieved through the successful introduction of the "Rhodia-Tongue" and the reduction of filter diameter.
- . A project has been initiated in order to provide technical assistance to all PME factories to improve filter consistency and machine efficiency as well as to reduce material wastage and manufacturing costs. Initial discussions took place in all manufacturing centers with representatives of Production, Engineering, Purchasing and Quality Assurance.
- . Monthly interlaboratory tests on main filter characteristics have been fully implemented using monitoring filters.

## 6. FIRMNESS

- . All firmness instruments in PM-Europe have been checked by R&D through on-site visits. The influence of even slight temperature variations on firmness has been proven and corrective actions initiated.

## 7. SMOKING LABORATORY

- . The method for water and nicotine analysis in smoke condensate has been changed. Gas chromatography has been introduced to replace the analyses by Technicon.

## 8. AUDITS/ASSISTANCE TO LICENSEES

- . Upon request of local management, the quality system in the Tenerife factory has been audited. Conclusions have been presented and are currently being discussed.
- . On-site visits have been made to various Licensees with the objectives of improving visual quality or assessing actual quality systems.

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## THREE-YEAR PLAN 1991 - 1993

### QUALITY ASSURANCE AND TECHNICAL SERVICES

#### I. AGGRESSIVELY SUPPORT THE CURRENT BUSINESS

##### A. Objective

Ensure the standardization of procedures and analytical methodology within the framework of Quality Assurance, in order to guarantee quality consistency and uniformity of our products throughout PME. Ensure coordination with PM-USA.

##### STRATEGIES

###### 1. Incoming Inspection

- . Ensure that PME incoming inspection/material monitoring procedures fulfill legal requirements.
- . Continue the revision and updating of methods used for the analysis of ingredients, filter additives and adhesives. Complete new specifications by 1991. Standardize with PM-USA. Revise the incoming-inspection procedure for these items.
- . Continue the revision of packaging-material specifications and complete it by end 1992.
- . Finalize, together with Purchasing, the supplier-rating system. Based on the supplier rating, set up a supplier-improvement program.
- . For selected items, introduce an acceptance procedure based on supplier certificates, audits and quality records.
- . Continue efforts for the introduction of concentrated base flavors for Marlboro production, thus standardizing the flavor system with PM-USA and contributing to substantial cost savings.

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2. Subjective Testing

Review and standardize the methodology used for taste evaluation while considering the results of the monitoring initiated in 1989.

3. CORESTA/ISO

Participate in the Company's efforts leading to the approval of appropriate testing methods of ours and competitors' products, with emphasis on cigarette analysis and physical characterization of tobacco.

4. Analytical Smoking

Take advantage of the PM Smoking Laboratory working group, created in 1989, to adapt current PME procedures to the new requirements of CORESTA/ISO methods when the latter are enforced. Another main objective of the task force is to harmonize smoking procedures.

5. Primary

Take advantage of the primary working group, established in 1990, to standardize critical methods and specifications in the European Primaries.

6. PM-Spain

Integrate PM-Spain into the PME-QA system through technical assistance, training, interlaboratory tests and monitoring. Ensure that products comply to legal and PME requirements.

7. Physical Testing

Set up a QA task force for the analysis of physical cigarette parameters. Ensure through revision of methods and interlaboratory tests that results reported by the various laboratories are comparable.

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## B. Objective

Establish and maintain efficient product auditing systems in order to ensure optimization of product quality.

## STRATEGIES

### 1. Material Evaluation/Testing

- . Continue audits of main suppliers of nontobacco materials.
- . Selectively reduce material inspection in the laboratory for standard materials.

### 2. Cigarette Information

- . Review current cigarette-information activities in order to support Marketing and Product Development with information on the market situation. Ensure quick information on competitors' products. Replace the actual "Coldac" system by the DEC-Beckman CALS data acquisition system.
- . Study, with Product Development, the possibilities to use the actual data base to produce comprehensive reports on important cigarette properties, e.g., tar/SN ratio, tar per puff, etc. This information would enable correlating market data with cigarette characteristics.
- . Develop the actual monitoring function for cigarette-information laboratories to cope with the increasing number of official laboratories in the two regions. Strengthen contacts among specialists within our Affiliates.
- . Develop the capacity of the cigarette-information laboratory to cope with future needs. Contribute to the project of a new smoking laboratory.

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### 3. Filter and Firmness Monitoring

Make use of the reports created in 1989 in order to identify opportunities for improvement and act as a catalyst within the region for the dissemination of respective technical solutions.

### 4. Visual Inspection

- . Introduce the new visual inspection handbook, prepared in cooperation with PM-USA, in all Affiliates and Licensees. Standardize visual inspection throughout the region and with PM-USA, which will lead to an increased objectivity of product evaluations.
- . Introduce VQA-laboratory monitoring.
- . Replace the current centralized factory audit system by a standardized and comparable local audit. Increase efforts for centralized market audits.

### 5. Customer Complaints

Set up, together with Marketing/Sales, a procedure for an efficient and objective acquisition/evaluation of customer complaints. Standardize this procedure throughout PME and use the results for defining of QA-objectives.

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### C. Objective

Develop Quality Awareness within Philip Morris Europe.

### STRATEGIES

#### 1. Workshops / Seminars

- . Promote the organization of seminars, workshops and quality campaigns within PME Affiliates and Licensees.
- . Organize seminars to improve the utilization of statistics in quality assurance.

#### 2. Training Tools

- . Review and update the slide show "Quality Assurance in the Cigarette Industry".
- . Develop a training program on infestation control and fumigation.

#### 3. Salesforce / Distributors

Protect product quality in the market place by making Quality-oriented training programs available to the salesforce and PM distributors.

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#### D. Objective

Develop product knowledge and master new technologies in order to ensure our technical expertise and responsiveness. Promote the transfer of current and newly developed technologies within the PME Quality Assurance Departments.

#### STRATEGIES

##### 1. Tobacco Monitoring

Analyse the physical characteristics of the tobaccos used in PME and correlate them to the yields in Primaries and Secondaries as well as to the finished-product quality.

##### 2. Consumer Perception of Quality

Evaluate information available on the consumers' perception of cigarette quality. Make use of the data for targeted product quality improvement.

##### 3. Machinability of Materials

Identify supplies' specific parameters that influence machinability and develop related testing methods. Ultimately, revise material specifications accordingly.

##### 4. Filter

Further develop "filter manufacturing support" and provide technical assistance to PME factories to improve filter consistency and machine efficiency as well as to reduce material wastage and manufacturing costs.

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5. Quality Problem-Solving

- . Make use of visual inspection results to detect common problem areas and propose action plans.
- . Develop the flow of information between PME and PM-USA to address and exchange specific quality-related improvements, e.g., aspect quality.

6. High-Speed Machinery

Study the impact of increased automation brought about by the new machine generation on current QA activities. Revise procedures accordingly.

7. PME Affiliates/Licensees

Provide assistance to all manufacturing centers for quality-related programs/problems.

8. External Official Testing Laboratories

Maintain close contact with official testing laboratories. Ensure that official laboratories test correctly PM products through adequate monitoring, and provide scientific assistance in areas that are critical to our business, e.g., GCC.

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9. Infestation Control / Fumigation

- . Assist AOD in the implementation of the new PM infestation-control program in the production and storage areas of our Licensees.
- . Improve the quality of PME tobaccos with respect to infestation control through training our leaf suppliers in phosphine fumigation.
- . Study/develop, together with PM-USA, alternative technologies for pest control which could efficiently replace phosphine fumigations.

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### THREE YEAR PLAN 1991-1993

#### RESEARCH

#### PRESENT POSITION

- Analytical support in all areas of cigarette manufacture has been intensified. In conjunction with Packaging Engineering EEC and PM suppliers, an ongoing program is directed at finding further printing systems (offset, water-based) which are subjectively acceptable.
- Blend components and ingredients used by PMG are regularly screened to ensure compliance with the German Food Law.
- A program with PME Process Development was aimed at optimizing oriental tobacco treatment in primary processing. Treated tobacco has been favorably evaluated by Panel A. The program has been transferred to Process Development for industrial trials.
- In-house research programs on ETS in offices are continuing with extended analytical coverage. Assessment of the methods through collaborative studies is pursued. Support and control of independent laboratories subcontracted to work on ETS is continuing in co-operation with S&T.
- The program to investigate the influence of various cigarette wrappers including double wrappers on sidestream smoke yields has been completed. Sidestream determinations as support to Product Development PME and PM-US are continuing to be performed.
- A study to investigate whether ozone can be measured with commercially available instrumentation in the presence of sidestream smoke and ETS has been completed.
- The routine measurement of sidestream smoke yields in nicotine, particulate matter and carbon monoxide by using a four-channel single-cigarette apparatus has been extended to the determination of sidestream smoke visibility. The monitoring of total sidestream smoke is under development.

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- EEC, EEMA and competitive brands are continuing to be screened for selected filler and smoke components.
- InfraAlyzer methods to determine main components in base and application flavors are being implemented in PMG Munich and Berlin factories.
- Improved analytical methodology for determining critical pesticides on tobacco (e.g., MH-30, DTC) has been developed and is being implemented. Monitoring of pesticide residue levels in leaf tobacco and in finished products is continuing as to be in compliance with the specific laws of the EEC and EEMA regions.
- An integrated biocontrol system to prevent microbiological activity during tobacco processing and storage was developed.
- The identification of tobacco-identical inhibitory compounds isolated from Oriental tobacco is continuing.
- A program to investigate the influence of processing conditions on tobacco microbiology and subjective quality of the final product was initiated.
- Microbiological support to PM affiliates and licensees to control shelf life in tobacco storage and processing is continuing.

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THREE YEAR PLAN 1991-1993

RESEARCH

I. AGGRESSIVELY SUPPORT THE CURRENT BUSINESS

A. Objective

Improve product quality by the development and application of new analytical methodology.

Strategies

Develop new approaches to identify and solve off-taste/off-odor problems in PM products.

Introduce gas chromatography coupled with Fourier transform infrared spectroscopy to extend identification capabilities.

Maintain and further develop a program to correlate subjective and chemical changes in cigarettes caused by different printing techniques used for packaging materials. Extend program to offset and water-based printing systems and to the EEMA region.

Assure that sidestream yields of PM products are in compliance with future internal guidelines and provide regular market-place surveys.

Intensify efforts towards implementation of NIR technique in production areas.

Speed-up pesticide residue routine analyses by developing and implementing GCMS-based screening techniques for classes of pesticides.

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B. Objective

Monitor the compliance of blend components and ingredients with the legal requirements in both EEC and EEMA regions.

Strategies

Maintain and continue to upgrade the monitoring program for chemical constituents in all materials going into the fabrication of a cigarette so as to be in complete compliance with specific laws within PME.

Continue monitoring of pesticide residue levels in leaf tobacco and finished products.

Extend program to new pesticides as requested by PME management and/or legal requirements of the EEC and EEMA regions.

Strongly support Leaf Department in controlling critical pesticides (e.g., MH-30, DTC) in PM brands.

Centralize and computerize in co-operation with PM-US information regarding legal situations and requirements in the fields of pesticides, additives and packaging materials of all EEC and EEMA markets, in order to be able to immediately react to legal changes.

C. Objective

Assess the impact of environmental tobacco smoke (ETS) on indoor air quality in order to provide maximum technical assistance to corporate affairs.

Strategies

Continue the in-house program to monitor selected ETS components in real life environments during the course of controlled smoking sessions.

Support independent outside ETS studies in direct co-operation with PME-S&T aimed at assessing ETS exposure and its impact in real life environments.

Improve on existing analytical methods for assessment of ETS exposure, e.g., find more restrictive determinations of ETS related to respirable particulate matter.

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D. Objective

Support corporate affairs in defending industry position.

Strategy

Actively participate in inter-company analytical programs leading to industry and government accepted methodology.

II. DEVELOP PRODUCTS WHICH ADDRESS THE CONSUMERS' DESIRE TO REDUCE THEIR HEALTH CONCERNS

A. Objective

Acquire technical information necessary to develop new products or to modernize existing ones so as to have acceptable products with excellent commercial quality available.

Strategies

Reduce the pyrolysate fraction of cigarette smoke condensate by modifying the cigarette filler and maintain at the same time the consumers subjective acceptability of the modified product.

Evaluate new filter concepts as generated within and outside of R&D to determine product advantages in the market-place due to selective elimination of certain smoke components.

III. DEVELOP PRODUCTS WHICH ADDRESS THE PUBLIC'S DESIRE TO REDUCE ENVIRONMENTAL TOBACCO SMOKE

A. Objective

Develop basic knowledge to focus on problems related to the development of new products which addresses the environmental tobacco smoke (ETS) issue.

Strategies

Continue the program to investigate the formation of undesirable components in aging cigarette sidestream smoke and develop an understanding of how to control them.

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Study the effect of cigarette parameters and filler additives on total sidestream smoke yield and in particular on gas phase composition.

Investigate ways to diminish the sensory impact of environmental tobacco smoke.

IV. DEVELOP NEW PRODUCTS WHICH CAN BE MARKETING USING CURRENT STRATEGIES AND GIVE SMOKERS A PRODUCT ADVANTAGE

A. Objective

Contribute to the development of new or improved products designed to give tailored delivery profiles by providing analytical data and developing new analytical methodology to meet the needs of Product Development.

Strategies

Maintain the program for the measurement of puff-by-puff mainstream smoke deliveries of selected components. Upgrade methodology for use as a routine analytical method by QA.

Identify the causes of the development of butt odor in order to eliminate them.

V. IDENTIFY NEW PRODUCT/INTERNATIONAL PROCESS CONCEPTS AND DEVELOP PRODUCTS/PROCESSES FOR THE INTERNATIONAL MARKET

A. Objective

Improve the taste characteristics of tobaccos.

Strategies

Correlate subjective, chemical and microbiological changes in cigarettes caused by primary processing practices.

Continue monitoring of temperature and water activity in tobacco processing in our European primaries.

Study the impact of processing conditions on tobacco microbiology and the resulting effects on product quality.

Control tobacco microbiology and sensory characteristics by implementing microbial processing specifications.

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VI. PROVIDE A BROAD FOUNDATION OF BASIC RESEARCH THAT WILL  
GENERATE NEW PRODUCT CONCEPTS IN 5-15 YEARS

A. Objective

Maintain the scientific, technical and innovative base required to support PME's emerging business.

Strategies

Develop technical expertise through the training of Research personnel.

Encourage innovation by patenting and publishing research results.

B. Objective

Continue basic research on tobacco microbiology and develop applications in the field biotechnology within PM which will favorably impact on new or existing products and/or processes.

Strategies

Continue research towards more appropriate natural preservatives and pesticides to provide alternatives to existing systems.

Improve product quality by bio-removal of specific tobacco compounds in close co-operation with an external institute.

Continue to study the physiology of identified bacteria as a function of tobacco water activity and heat treatments in primary processing.

Study the metabolism of these bacteria and evaluate their impact on the subjective quality of the finished product.

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### THREE YEAR PLAN 1991 - 1993

#### PROCESS DEVELOPMENT

##### PRESENT POSITION

The Process Development Division establishes and implements programs aimed at product and process improvements for affiliates and licensees in both PME regions in order to contribute efficiently to the operational goals on quality, cost, productivity and flexibility.

During the past year significant progress was achieved in a number of Process Development programs. Our group has in general concentrated more efforts on larger projects, particularly those related to ET and primary processing in our European affiliates.

- The tobacco process quality program was continued and further improvements were achieved regarding the consistency and interpretation of the data, the reporting format and the inclusion of highlights. Monthly reports and quarterly comparisons were published.
- The cross-evaluation of European and US ET was completed. Trials were successfully run in the Richmond M/C DIET facility, the ET pilot plant and in the PMG ET installation in Berlin.
- An optimization and standardization program regarding the ET plants in our European affiliates was initiated. Review visits for the evaluation of process operating and quality parameters were completed and improvements were implemented.
- Standardized information of primary equipment and operations was completed for and presented in Bergen op Zoom and Berlin. The other two affiliates, Munich and FTR, are scheduled for completion by the end of 1990.
- Further improvements were implemented in the Miniprimary which continues to operate smoothly. The replacement of a steaming conveyor by an HT Tunnel was studied and is planned for installation during 1991.
- Several studies requested by the Leaf Department were completed, are in progress or near completion. These include the evaluation of ripper short sieving, cross cutting trials in the Miniprimary, small lamina removal in the primaries and the FC and BU Malawi study.
- We contributed to the PM Process Synergy Meeting and a presentation was given at the 1990 Tobacco Colloquium.

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- Assistance was provided to AOD of both regions, particularly for primary project reviews, ET and stem process evaluations at MTI in Bologna, Verona and Trieste.
- The Burley standardization and capacity increase was completed for Munich and is in progress in Berlin including start-up and qualification of their new P&S dryer.
- Completed projects include BBS in Munich, ET trials for Swedish Tobacco and China at FTR and evaluation of FC and BU tobaccos from Turkey.
- The evaluation of the COMAS stem puffing system was initiated and is partially completed.
- Assistance was provided to BOZ in trial processing of a Marlboro blend through the Dickinson direct cylinder conditioning, backed up by trials at COMAS with their slicer and DCC system.

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## THREE YEAR PLAN 1991 - 1993

### PROCESS DEVELOPMENT

#### OBJECTIVE 1

Develop and implement programs focused on standardization of primary processes and tobacco materials among PM European affiliates and with PM USA.

#### Strategies

- Optimize and standardize processing parameters and operating conditions in the four European ET plants for improved consistency of operations and interchangeability of the ET product.
- Organize technical review meetings with participants from all European ET plant locations and assist in solving specific problems as required.
- Streamline the tobacco process quality program and implement the take-over by QA of the routine reporting.
- Continue to review and interpret primary data, particularly for defining trends and factory comparisons, with various groups from affiliates and R&D.
- Complete the programs for standardizing the Burley processing in Berlin, including start-up and qualification of the new P&S dryers.
- Develop and implement a program for increased cutting OV.
- Be involved in the evaluation and the installation of foreign matter detection and removal systems.

#### OBJECTIVE 2

Assist in implementing the capacity increase program for primary processing equipment in co-ordination with the PME affiliates to meet the goals set by Operations.

#### Strategies

- Contribute to the implementation of the primary extension programs by assisting in the establishment of the engineering projects for new primary equipment. Projects include the primary extension and the new ET plant in BOZ, the installation

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of LEGG dryers in Berlin, the BBS processing and cut filler pack-out in Munich, the separate ET line in FTR Onnens and the FTR primary improvement program.

- Participate in planning meetings to discuss design concepts and layouts.
- Provide assistance for selecting equipment and defining process parameters, for start-up and qualification of new equipment or modified processing lines.

### OBJECTIVE 3

Increase the level of technical assistance for primary process quality assessment and optimization within affiliates, licensees and other groups of both PME regions.

#### Strategies

- Respond to Manufacturing requests for assistance. Develop and complete programs, evaluations or blend component studies.
- Perform project reviews, establish recommendations for process improvements and provide assistance and consulting service to licensees to improve unit operations, stem treatment and ET processing.
- Participate in workshops and provide training for licensee personnel.
- Further optimize the operation of the Miniprimary and the support laboratory for increased flexibility, improved safety and maintenance.
- Implement the HT project in the Miniprimary in 1991.
- Complete the project for a data acquisition system in the Process Development laboratory.
- Complete the evaluation of small lamina removal from strip in the stemmeries, their utilization, and implement the follow-up accordingly.
- Evaluate the results on the total blend sieving and cutter by-pass in the PM Australia primary and develop recommendations for Europe.
- Investigate the utilization of factory generated OTM's.
- Implement trial programs adequately as required and further improve planning, data interpretation and reporting.

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#### OBJECTIVE 4

Develop, evaluate and implement new processing technologies for potential application in PM facilities.

##### Strategies

- Complete the evaluation of the COMAS stem puffing process.
- Continue the evaluation of direct cylinder conditioning as an alternative to vacuum pre-conditioning.
- Evaluate cut filler recovery from Winnowers.
- Stay abreast of the development of new cast sheet and expansion technologies by Richmond R&D.
- Participate and support programs related to reconstituted tobacco processes and materials as required.
- Identify technologies in industries similar to ours and intensify contacts with equipment suppliers to keep abreast of new developments.

#### OBJECTIVE 5

Further improve our expertise and technology transfer through exchange and co-ordination with the technical community.

##### Strategies

- Complete the documentation on standardized primary information for all European affiliates.
- Outline major differences between primaries. Establish and implement an up-date procedure on a yearly basis and develop general primary guidelines.
- Organize the 1991 Tobacco Colloquium, participate and contribute to synergy meetings with other PM units.
- Continue to improve technical expertise and flexibility of the Process Development personnel by further intensifying on-the-job cross-training.
- Ensure professional training and rapid integration of new process engineers.

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## **APPENDIX C**

### **Technology Review**

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### **Areas of Particular PM USA R&D In-House Expertise**

The PM USA R&D staff includes personnel with training and/or experience in most areas of science and technology. The listing below indicates the areas of particular expertise which are pertinent to the current Programs.

Alkaloid Chemistry	Chemistry of nicotine and related compounds.
Carbohydrate Chemistry	Chemistry of cellulose, starch and sugars.
Cigarette Design	Specification of cigarette parameters to produce desired smoking characteristics.
Combustion/Pyrolysis Mechanisms	Physical mechanisms & chemical pathways which control thermal decomposition.
Computer Simulation	Use of computers to replicate and predict the behavior of physical systems.
Consumer Testing & Product Evaluation	Test design and analysis to determine consumer attitudes and product preferences.
Electron Microscopy	Research applications of transmission and scanning electron microscopes and associated instrumentation.
Expansion Science & Technology	Hydrate formation, blowing processes, thermal hardening as they relate to tobacco expansion.
Expert Systems	Design of computer systems to make or guide decisions or control processes.
Filtration Processes	Physical and chemical processes to remove vapor and/or particulate components from air or smoke.
Flavor Chemistry & Formulation	Preparation of natural or synthetic compounds to produce desired subjective responses.
Image Processing	Acquisition and manipulation of digital image data for measurement, recognition or inspection.

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Instrumental Chemical Analysis	Design and use of instruments for determining the nature and concentration of chemical species.
Microwave Theory & Technologies	Use of microwaves for basic studies of materials, or operations such as moisture measurement or drying.
Neural Computing	Use of connected networks of simple computing elements for recognizing input information or determining relationships between sets of information.
Nuclear Counting	Measurement of extremely low levels of radioactivity. Use of radiochemical detectors.
Optical & Laser Technologies	Theoretical and experimental optics. Laser applications.
Organic Synthesis	Production of organic molecules from precursor compounds or elements.
Paper Making & Development	Paper design, fillers, surface treatments, manufacturing.
Perforation Technologies	High speed laser and electric spark perforation of paper.
Separation Technologies	Supercritical fluid, membrane and fixed bed separations.
Sheet-Making Processes	Cast & reconstituted tobacco sheet.
Statistical Process Control	Applications of statistical analysis to process control and problem diagnosis.
Theoretical Chemistry	Mechanisms controlling chemical structure and reactions.
Thermal Physics	Mechanisms of heat storage and transfer.

**1990**  
**PM USA R&D Collaborative Research Programs**

Program Description	Location	Budgeted Amount (\$000)	
		1989	1990
Heat Sources/Combustion Modeling/ Sigma	NY Polytechnic	907.0	579.0
Project Delta/Sigma	Stone Products	100.0	40.0
Project Beta	Pinnacle Research	200.0	100.0
Project Beta	Motorola	0.0	1,145.0
Project Beta	Coors	0.0	145.0
Gustatory and Olfactory Research/ Flavor Development	Monell	30.0	0.0
Localization of Nicotine in Tobacco/ART	Cambridge Univ.	55.1	8.8
Use of MS/MS/Analytical Support	Univ. of Nebraska/ Univ. of Pittsburgh	3.0	0.0
Study of CO Sensors/ETS	VCU	13.2	13.3
Nornicotine Determinations/TSNA	Cumberland Consulting Chemists, Inc.	8.9	0.0
Preparation of Nicotine Antibody/ART	Litron Laboratories	19.9	8.3
Two Dimensional Gel Electrophoresis/ TSNA	PDI	20.0	12.5
cDNA Expression Library/TSNA	Various	5.0	7.0

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**1990**  
**PM USA R&D Collaborative Research Programs**  
 (Continued)

Program Description	Location	Budgeted Amount (\$000)	
		1989	1990
Protein Sequencing/TSNA	Various	4.5	6.0
Pesticide Work	Tobacco Pesticide Group	4.0	0.0
Neutron Radiography	University of Va.	142.0	150.0
Sol-Gel Research/Paper Tech.	NY Polytechnic	135.0	135.0
Low Level Counting	Battelle NW	20.0	15.0
Inorganic Binders/Paper Tech.		0.0	36.1
Lumen Loading/Paper Tech.	Univ. of Washington	18.0	0.0
Sol-Gel Analysis/Paper Tech.	VPI	38.2	90.0
Paper Technology	Univ. of Maine	60.0	60.0
Menthol Release	Callery Chem/Lee Labs	77.0	40.0
Custom Synthesis	VCU/Aldrich/Lee Labs	0.0	183.5
Cluster Formation (Aerosols)	Colorado State	109.5	92.9
Oxidation Catalysts/Selective Filtration	Seton Hall Univ.	0.0	76.1
Project Sigma	Procedyne	229.0	0.0

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**1990**  
**PM USA R&D Collaborative Research Programs**  
(Continued)

Program Description	Location	Budgeted Amount (\$000)	
		1989	1990
Optical Processing	Carnegie-Mellon	54.4	40.1
Dynamic Nuclear Polarization/Analytical Support	Colorado State	31.7	0.0
Simulation of Liquids & Aerosols/ART	VPI	38.7	43.3
Single Particle Aerosol Chemistry	Univ. of Washington	0.0	35.0
Thermodynamic Properties of Supercritical Fluids	Georgia Tech.	12.0	12.5
Supercritical Extraction	Supercritical Proc. Inc.	153.4	16.0
Project ART Water Column	University of Texas	27.5	27.5
Combustion Research/Beta	MIT	25.0	0.0
Project Sigma/Beta	Laser and Mechanical Systems	5.0	90.0
Aerosol Research	VCU	0.0	14.7
Optical Processing	Unicorn Systems	1.2	0.0
Project Sigma Development	Stackpole Company	395.0	230.0
Project Beta Development	Stackpole Company	0.0	193.4

**1990**  
**PM USA R&D Collaborative Research Programs**  
 (Continued)

Program Description	Location	Budgeted Amount (\$000)	
		1989	1990
Project Pact		0.0	108.1
Corrosion Research/ART	Dupont Safety Mgmt.	269.2	137.5
ART Pilot Plant Design		9.6	11.0
Aquarium Disposal Studies/ART		0.0	82.9
Carbon for Plug-Space-Plug-Filter	Stackpole Company	55.0	0.0
R&D Computer Operations	Index Group	44.0	0.0
Engineering Services	Nolen, Friska, Brooks	20.0	18.9
Emergency Response Team	FDM Safety Services	22.0	21.0
Contract Programming	Computer Horizons	42.0	0.0
Contract Programming	McKinney & Assoc.	13.0	0.0
Contract Programming	Fortex	15.0	0.0
Contract Programming	Various	18.0	7.8
<b>Total</b>		<b>3,451.0</b>	<b>4,033.2</b>

Collaborative Research Programs are budgeted in the following accounts:  
 Professional Services, Consultant Services or Purchased Services.

**RESEARCH PROGRAMS**  
**1989-1990**  
**Cosmic/Sensory Research**

	<u>1989</u>	<u>1990</u>
<b><u>Professional Services</u></b>		
Dr. Mangan	\$180.0	\$118.5
Dr. Eysenck	175.0	78.6
Dr. Harley	32.0	33.1
Dr. Ashby/Dr. Nosofsky	<u>0.0</u>	<u>72.4</u>
<b>Total</b>	<b>\$387.0</b>	<b>\$302.6</b>

**Consulting**

Dr. Eysenck	\$ 3.3	\$ 3.4
Dr. Haier	1.9	2.0
Dr. Harley	2.9	3.0
Dr. Mangan	3.8	4.0
Dr. Warburton	3.8	4.0
Dr. Frijters	3.3	3.4
Dr. Falmagne	1.9	2.0
Dr. Nosofsky	1.9	2.0
Dr. Ashby	1.9	2.0
Dr. Mullen	<u>5.3</u>	<u>5.5</u>
<b>Total</b>	<b>\$30.0</b>	<b>\$31.3</b>

**PM USA R&D  
1989-1990 Consulting Relationships**

Program Description	Consultant	Budgeted Amount (\$000)	
		1989	1990
ANSI	R. Dawson	\$ 4.0	\$ 4.2
Regulatory Agencies	J. Stoffberg	4.8	0.0
Chemistry and Biochemistry	A. Wolf	12.0	12.5
Analytical Chemistry	F. Hawkridge	2.5	2.0
Localization of Nicotine	P. Echlin	9.2	6.8
Spectroscopy/IR Methods Development	R. Jacobsen	0.0	5.3
Elemental Analysis	T. Rains	1.5	0.0
Wet Chemistry	Cumberland Consultants	0.0	4.7
Sequencing/Protein Isolation Separation Techniques		6.5	7.4
Analysis Development	Dr. Berntson	1.5	2.0
Electrophysiology	Dr. G. Kobal	2.2	0.0
Waveform Analysis		0.0	1.5
Cigarette Paper Properties	Dr. Mattina	24.0	6.5
Organic Chemistry		0.0	6.5
Pyrolysis of Cellulose and Paper and Aerosol Formation	Dr. Chum	0.0	4.0

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**PM USA R&D**  
**1989-1990 Consulting Relationships**  
(Continued)

Program Description	Consultant	Budgeted Amount (\$000)	
		1989	1990
Nicotine Removal and Destruction	Dr. Fair	\$ 0.0	\$ 4.0
Surface Chemistry	Dr. Somorjai	0.0	4.0
Inorganic Chemistry	Dr. Schleich	0.0	7.0
Supercritical Adsorber Columns	F. Seibert	0.0	4.2
Chemistry	D. Sawyer	8.0	0.0
Optical Components	A. Vanderlugt	7.0	7.3
Optical Processing	D. Casasent	4.0	0.0
Processing System	Dr. Fazzina	0.0	12.5
Alternate Adsorber	F. Seibert	4.0	0.0
Hydrate Technology	Dr. Sloan	0.0	2.0
Separator Design	Dr. Zenz	0.0	11.0
Structure Set		0.0	4.0
Process Modeling		0.0	8.0
Corrosion Research		3.0	0.0
Continuous Process	M. W. Kellogg	0.0	25.0
Extrusion Sigma/Beta	APV Baker	0.0	6.6

**PM USA R&D**  
**1989-1990 Consulting Relationships**  
(Continued)

Program Description	Consultant	Budgeted Amount (\$000)	
		1989	1990
Supercritical Fluids	University of Texas	\$ 0.0	\$ 15.1
Binder Mechanisms	Dr. Ruben	6.3	0.0
Process Engineering	Notre Dame	<u>0.0</u>	<u>11.0</u>
Total		\$100.5	\$185.1

## VISITING SCIENTISTS

1990

<u>Scientist</u>	<u>Program</u>	<u>Amount</u>
Dr. Wegscheider	Optimization in Analytical Chemistry, Chemometrics, Information Theory Related to Analytical Data	\$ 20,000
Dr. Phillips	High Speed Calculation of Complex Physics and Engineering Systems	60,000
Dr. Pat Bower	Molecular Biologist (Miller Brewing)	22,055
	<b>TOTAL</b>	<b>\$102,055</b>



### Science and Technology Areas Currently Under Development at PM USA R&D

Molecular Biology	Modification of plant systems to eliminate the production of selected compounds (e.g., Nicotine).
Artificial Intelligence Systems	Expert system based computer models. Current work includes cigarette design systems.
Catalysts for CO oxidation.	Work with Seton Hall University to develop low temperature catalysts for CO oxidation.
Chemical energy sources.	Research at R&D and with N.Y. Polytechnic University to identify new heat sources for the Sigma Program.
Ceramic Technologies	Applications of sol-gels as cigarette paper fillers. Ceramic heater materials for the Beta Program.
Computer Simulations	Collaboration with Virginia Polytechnic Institute and State University to provide new insights into aerosol formation and the role of hydrates in tobacco expansion. Heat and mass transfer modeling for the Sigma Program. Flow and process simulations.
Computer Technologies	High speed computing and machine communication. High performance workstations. Electronic information systems. Optical fiber networks.
Consumer Behavior Prediction	Psychophysical models of subjective response. Theories of market dynamics. Consumer testing methods.
Electrochemical Energy Sources	High energy/power density sources for the Beta Program.
Encapsulation	Release systems for menthol and/or flavors.
Fluid Jets	Accurate, high speed application of flavors or adhesives.
Monoclonal Antibodies	Rapid analysis for chemical and biochemical agents.

Natural Binders	Improved binder systems for tobacco or sheet materials.
Neural Computing	Neural network applications to complex mapping situations. (e.g. consumer preference from demographics)
Neutron Radiography	Thermal neutron imaging of cigarettes & smoke for product and/or combustion studies.
Nuclear Magnetic Resonance	High resolution tomographic imaging. Multiple pulse analysis techniques.
Optical Inspection	High speed imaging and analysis for real time product inspection. Work with Carnegie Mellon University on measurement of size, texture, connectedness, and color of disordered structures. Methods of foreign matter identification.
Paper	Development, using facilities at the University of Maine and Western Michigan University, of new paper and paper additive processes for the Paper Program.
Remote Sensing	Non-contact sensing of process and/or tobacco streams.
Separation Technologies	Supercritical fluid, membrane, fixed and fluidized bed separations of nicotine and/or minor alkaloids.
Supersonic Molecular Jets	Fundamental studies with Colorado State University of aerosol formation mechanisms and growth and chemistry of small organic clusters.
Tobacco Expansion.	R&D work on expansion mechanisms and technologies for improved expansion processes.

## Technology Assessment

The objectives of the R&D Technology Assessment effort remain to (1) define technology related needs, (2) identify areas of science or technology which may satisfy those needs, (3) develop those areas for our use and (4) recommend and facilitate the implementation of the technology. In pursuing those objectives we continue to maintain current awareness of numerous science and technology areas as they develop commercially or at universities. The Technology Assessment Group currently maintains contact with fifteen university departments, in addition to the contacts maintained by the R&D professional staff.

Activity continues in the three previously defined strategic technology areas:

**Paper:** The R&D Paper Program is making significant contributions to the basic understanding of sidestream smoke generation. During this plan period, the sol-gel work supported by this program is expected to provide new paper fillers for conventional as well as innovative smoking products.

**Optical Inspection:** The emphasis of the Optical Processing Program is currently on the implementation of commercially available hardware (and PM proprietary software) for on-line pack inspection as well as on-press inspection of printed materials. The recently initiated studies of optically implemented morphology operators are expected to yield technologies for inspecting tobacco filler and strip by the end of this plan period.

**Artificial Intelligence:** An expert system based cigarette design system has been implemented. This system is expected to contribute to R&D operations by expediting cigarette design operations and, ultimately, by reducing the number of semiworks runs. Neural computing technologies continue to develop rapidly and these have been adapted to PM uses. Recent success with the prediction of consumer response from demographic data suggests valuable applications for this technology during the next five years. The growth of artificial intelligence systems for on-line process control has been slower than anticipated. These may begin to be commercially available by the end of the plan period.

Other areas areas in which members of the R&D Technology Assessment Group are currently involved include:

**Catalysts for CO oxidation:** This work may produce PM proprietary catalysts for mainstream smoke or ambient air in 5 to 7 years.

Chemical energy sources: Currently in use in the Sigma Program.

Computer simulations: Completed studies have enhanced our understanding of humectant systems. Current studies of hydrate and liquid drop formation are expected to make similar basic contributions to expansion and aerosol generation technologies.i

Electrochemical energy sources: These studies will continue to identify and develop energy sources for the Beta Program.

Supersonic Molecular Jet Studies: This work continues to provide basic information about the structure and chemistry during the initial stages of aerosol formation. Work aimed at increased understanding of formation mechanisms shows increasing promise.

Tobacco Expansion: New process design based on improved understanding of hydrate formation, and of blowing and fixing mechanisms is expected to produce improved expansion processes during the next 2 to 3 years.

These and similar programs will be continued into the plan period, with increased emphasis on identifying the specific needs of the R&D Major Programs. Continuing emphasis will be placed on the *implementation* of developed technologies.

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